Municipal News and Water Works

Vol. LXXVI JANUARY, 1929 No. 1

Logic—A Challenge to Engineering Educators

Logic is taught in very few engineering colleges as a regular part of the courses. This seems to mean either that "the science of thinking" is not regarded by engineering educators as being a necessary part of an engineer's education or that it can be best acquired as a by-product of certain courses of study.

There is no doubt that pure and applied mathematics furnish excellent training in certain kinds of reasoning. But any one who has carefully investigated the subject of logic could scarcely fail to see that mathematics is insufficient as a training in logic. For example, mathematics does not discuss the use of language as a tool of reasoning. All books on logic stress this phase of the art of correct thinking, and whatever their weaknesses, their strength in this particular branch is undeniable. Indeed the syllogistic logic is little else than a sort of glorified grammar for thinkers. Lawyers receive an intensive training in the accurate use of language. Engineers, as a rule, do not receive such a training, and the resulting weakness is often very serious. Although the original object of language was to convey ideas (or, if you agree with that French philosopher, to conceal them), its main use to a thinker is to assist him in thinking correctly. Anyone who has studied algebra can appreciate the confusion and error that would occur if the symbol X were used to denote a velocity in the forepart of a demonstration and were carelessly changed later on to denote space traversed without regard to time. There are countless examples of just that sort of switch in the meaning of words used in discussions. Even worse, and much more common, is the failure to define important words. This is equivalent to assuming that the reader knows what you intend to signify by the letter X without your telling him. Curiously enough, if you are asked to define some important word, you will usually find that you can not do it off hand in such a manner as to stand any rigorous test.

Take, for example, the word conceive, and try to define it. Unless you have previously given a good deal of thought to its meaning you will almost surely fail to define it properly. Yet, it is a word that you probably use frequently. You speak of great distances, such as the distance to a star, as being inconceivable. Yet you do not hestitate to reason about such great distances by comparing them with one another, and with small distances. Do you admit, then, that you can reason about inconceivable things? If so, you can be easily run into a logical cul-de-sac. Then your only escape is by revising your statement of inconceivability, so that it amounts to this: A great number is not picturable at one glance, but may be conceived by successive additions (or multiplications) each of which is picturable. Conception, in other words is not necessarily a mental instantaneous picture but it may be a mental moving picture that involves a long time.

We have used this particular example because there have been many important scientific debates that have really hinged on the meaning of the word conceive, and in most of those debates not one of the debaters has seen that it was necessary to define the word conception.

We learn the meanings of most words by hearing them used in association with things and with other words that we already know. Hence all of us have acquired the sloppy habit of thinking that there is no need of carefully defining commonly used words. We take it for granted that we know their exact significance and that our hearers also know it. It is somewhat of a jolt to our confidence in this respect when we find that we can define relatively few words with exactitude. Just this sort of jolt is what we get when we study logic, and few of us ever get it otherwise.

Unfortunately most of the existing text books on logic devote only a single chapter to the subject of definition, and have little to say about research logic. On research logic or inductive logic as logicians have preferred to call it, Mill's discussion has been copied by other authors, almost slavishly, and it is an altogether unsatisfactory presentation of what should be the most valuable part of logic.

Doubtless it is the obvious defects of text books on logic that have served to turn engineering educators away from the study of it as a desirable part of an engineering course. But this very weakness should encourage professors of engineering to attempt to convert logic into the powerful educational instrument that it seems susceptible of becoming.

"Logic for Engineers," as several professors have remarked in correspondence with the editor, is about as poor a title for a book as "English for Engineers." English is English, and logic is logic. True, but the general treatises on logic have been so unsatisfactory to scientific men that some distinguishing title seems desirable for any new book that is to differ much from the Aristotelian syllogistic logic and Mill's inductive logic. Perhaps a better title may be "Research Logic"; at any rate the editor has in preparation a book that will bear that title.

All productive thinking calls for some amount of research on the part of the thinker, whether it be the thinking involved in designing a culvert or the thinking involved in the discovery of a law of nature. In every case there should come first the gathering of data that seem to bear upon the problem. During the process of data gathering, theories, new or old, should direct the classifying of the data, and the interpretation of their significance. New relationships may then be discovered, or old ones may be seen exemplified. Each problem, however small, becomes one of growing fascination, and takes on an importance that drives the investigator to do his best in solving it. Contrast such an attitude with the more common one of merely seeking some sort of a solution that will "get by." Contrast the method of thorough search for pertinent data with the more common one of presenting the engineering student with all the required data either in the

statement of the problem or in some handy reference book.

Existing text books on logic furnish little more than the barest hints on the gathering of data. Their authors seem to think either that this is not a teachable process or that every student has an instinct that will lead him in such searches. Yet data gathering, the editor finds, is by all odds the most difficult process that confronts the reasoning mind. That it can be taught is almost self-evident. That it is not ordinarily taught is well known. That no instinct leads the average man, or even the educated man, to become a thorough collector of pertinent data before drawing his final inferences, is a matter of such common knowledge that we need not dwell upon it. In fact science came into existence only after a few men, here and there, saw clearly the necessity of gathering and classifying facts relating to the properties of matter. Even yet the percentage of men who see this necessity is pitifully small. The rapidity of our whole future economic progress will depend mainly upon the rate at which this percentage will be increased.

The interpretation of data thus gathered is another branch of research logic, and one whose importance is scarcely less than the gathering of the data. Such interpretation takes the form of scientific theories. It is the editor's belief that there is more than "scientific intuition" involved in originating correct theories, and that methods of originating such theories can be taught. "Scientific intuition" itself may be nothing else than good method coupled with good memory; the former being teachable, the latter susceptible of being improved by training.

Magnetism vs. Gravitation As a Cause of Many Air Currents

Are barometric gradients the main causes of our cyclonic air currents, or are they the effects thereof? We do not recall ever having seen such a question in print before, yet we ask it in all seriousness. It has been taken for granted that all air currents on our globe are caused by the force of gravitation, somewhat modified at times by centrifugal force. The barometer registers differences in air pressure and all winds are supposed to be the result of such differences. While it is undeniable that many winds are merely convection currents, it may be that the major movements of air are electromagnetic phenomena.

Elsewhere in this issue it is shown that certain (perhaps all) cyclonic storms travel in parabolic paths. It will puzzle physicists to explain such a path on the theory of gravitative pressure and centrifugal force. Yet it is readily explainable on an electromagnetic hypothesis.

The cyclonic rotation of storms has been explained by the hypothesis that centrifugal force is stronger in the lower latitudes. But what becomes of this explanation when applied to a small whirlwind a few feet, or even a few inches, in diameter? Is a difference of a foot or so in latitude sufficient to account for one of those very intense though small dust whirls that are so often seen?

If the whirling motion of cyclonic storms finds unsatisfactory explanation in treatises on meteorology, even more unsatisfactory are the reasons given for the eastward trend of such storms. How does it happen that they travel faster than the earth rotates? Is it because they are carried along by upper air currents? Then why do the upper air currents move eastwardly? And why do cyclonic storms advancing in a series have velocities inversely proportional to their distance apart?

Cyclonic storms have centers of low pressure, and they are followed by anticyclones that have centers of high pressure. Why don't the "highs" flow into the "lows"? What conceivable arrangement of high and low pressure areas can cause a continuous eastward movement of both high and low pressure areas? How can the earth's rotation impart a continuous and greater eastward velocity to air than the earth's rotative velocity?

Our search for satisfactory answers to these questions has been fruitless. If you are weak in physics and strong in credence when authorities speak, you may find satisfaction in some of the answers, but if you insist on physical demonstration that carries conviction, you are certain to be disappointed.

Sunspots are cyclonic storms in the sun's atmosphere. They have many features that are strikingly like our cyclonic storms. Since meteorologists explain the latter as being the results of flow of cold polar air equatorward, we wonder how they would explain the former, sunspots. How would they explain the rotation of sunspots? Since sunspots move forward with exceeding slowness, centrifugal force could hardly account for their rotation.

Sunspots are powerful electromagnets, as Hale has shown. It is therefore probable that their rotation is an electromagnetic phenomenon. If so, analogy suggests that their first cousins, our cyclonic storms, are also electromagnetically rotated. We know that all air contains "free" electrons. We know that "free" electrons in motion constitute an electric current. We know that "free" electrons in rotary or orbital motion constitute an electromagnet. So we may infer with certitude that every one of our cyclonic storms is an electromagnet. What we do not yet know is their magnetic strength. But when we see them rotating and progressing in a manner that shows great power, we may infer that our cyclonic storms are whirling masses of ionized air that are powerfully electromagnetic, taken in the aggregate. This of course does not imply that a relatively small volume of such air will show great magnetic force. We should no more expect that than we should expect to find a powerful gravitative pull between two clouds.

If electromagnetic force rotates and propels the air of our cyclonic storms, and if periodic changes in the size and intensity of such storms account not merely for weather changes but for climatic changes, it follows that electromagnetism is fully as important a factor as convection currents. Indeed it seems to us to follow that convection is to be regarded as less important.

Finally, does it not seem probable that if air is rotated electromagnetically, the low pressure within such a rotating mass is a result of rotation? If so, it must follow that many important barometric gradients are the results of air currents, and not their cause.

H. P. Gillette

The Parabolic Path of Cyclonic Storms

By HALBERT P. GILLETTE

AS announced in a previous article, I believe that all cyclonic storms are rotated by the electromagnetic energy of the earth. Many storm phenomena are thus explained. That cyclonic storms are propelled eastward and toward the equator electromagnetically is a corollary of this electromagnetic whirl theory.

Being an electromagnet itself due to the presence of free electrons in the vortex of air, a cyclonic storm would be driven from the more intense parts of the earth's magnetic field to the less intense, or toward the equator. It would also be propelled laterally.

The resistance of the air results in a constant velocity of a storm in its eastward or latitudinal direction, just as a falling raindrop soon attains a constant velocity. But the force that propels the storm meridionally toward the equator has a negative increment, due to the opposite polarity of the two ends of the magnetic field of the earth, the resultant being zero at the magnetic equator.

Hence we have a phenomenon that resembles the movement of a jet of water ejected horizontally under a constant head. The constant horizontal velocity of the jet corresponds with the constant latitudinal velocity of the cyclonic storm. The steadily increasing vertical velocity of the jet corresponds with the steadily decreasing meridional velocity of the storm. Hence, since the path of a water jet is a parabola, that of a cyclonic storm should be a parabola, unless changed by other wind movement. As a matter of fact this is the case.

For example in Clayton's "World Weather," p. 125, there is shown the path of a cyclonic storm from Finland to Vladivostok, north of Korea. This storm center moved about 15 degrees south while travelling about 60 degrees east; and taking various coordinates along its path from Finland, its eastward distance of travel varied as the square of its southerly distance, showing the curve to a parabola.

This law of parabolic paths of cyclonic storms can be used to determine the point of origin of such storms, as well to forecast the path from known coordinates.

Clayton (p. 269) states, as an empirical law, that the velocity of a cyclonic storm center varies inversely as the "length of the solar cycle" of activity that caused the storm. He means (p. 267) that the velocity of a cyclonic storm varies inversely as the period of time between successive storm centers as they move in a periodic series.

Clayton gives no reason for this law, other than an analogy between the velocity of ocean waves and storm waves (p. 112) but the analogy, it seems to me fails to apply, for the velocity of ocean waves increases as the distance apart increases, whereas the converse is true of storm "waves."

Clayton (p. 203) thinks that cyclonic storms are carried eastward in temperate latitudes by the general eastward trend of the air. If so, why do cyclones not travel northeastward, in the northern hemisphere, instead of southeastward? The northeastward trend of the north temperate zone itself calls for explanation, and no satisfactory explanation is to be found in the heat convection theory. We have northeasterly equatorial trades in the same hemisphere that we have southwesterly temperate winds, so that we can not invoke the earth's centrifugal force to explain the one without running into difficulties over the other.

The fact is that the convection theory of cyclonic storms falls down at nearly every turn, and no amount of bolstering with other forces, such as centrifugal force, serves to keep it on its feet. On the other hand, the electromagnetic theory explains every characteristic of such storms; and, as above indicated, it explains some characteristics with mathematical precision.

Let us consider Clayton's law of reduced storm velocity when storm centers are farther apart. Convection yields not the slightest clue to such a law; but electromagnetism does. Since parallel electric currents attract one another, and since free electrons in air moving in mass constitute parallel electric currents, a rotating mass of air should tend to concentrate into a belt or ring of rotating air having a somewhat quiescent center. Moreover, the greater the velocity of rotation, the greater the tendency to such concentration. But the greater the concentration and the greater the velocity, the stronger the electromagnet. The stronger the electromagnet, the more rapidly it is propelled by any other magnet. Hence cyclonic storms of small diameter travel more rapidly because of the greater intensity of their electromagnetism, also because their small diameter reduces the friction of the quiescent air through which they travel.

The magnetic needle shows varying deflections during storms, but this has been regarded as a secondary phenomenon, resulting presumably from the static electricity caused by friction, whereas I regard such magnetic changes as being a primary phenomenon resulting from the motion of free electrons with the air currents.

It is not impossible that the whirling belt of air that constitutes a cyclonic storm may itself be rising but slowly if at all, and that the air that is ascending is the air within the whirling belt, where rarefication is caused by the flow of air toward the rotating belt. But I am inclined to think that electromagnetism plays a very important part in raising the current of ionized air.

Humphrey's "proof" that electricity can have little effect on air motion is based solely on consideration of the attraction of electrostatic charges. Hence it has no bearing whatever on air movements caused by electromagnetism, a phenomenon that he seems to have overlooked.

Cyclonic storms originate in high latitudes and travel eastward and toward the equator, dying out in lower latitudes. This phenomenon bears strong resemblance to sunspots, except that the velocity of sunspot travel is relatively slow. Perhaps this difference in velocity is explainable on the theory that the upper and lower fields of magnetism more nearly balance in their effect upon sunspots than is the case on the earth. Incidentally this theory may explain the periodic reversal of polarity of sunspots, discovered by Hale. It can be seen that sunspots (being electromagnets) must tend either to repel or attract the ionized atmosphere above them (which, through its rotation causes the upper magnetic field). Hence a predominance of sunspots of a given polarity would warp the upper magnetic field. It is easy to picture a consequent alternate up and down warping of the upper field, so as to cause the lower (and less movable field) to predominate in its magnetic effect when the upper field is warped to a higher elevation. This would cause a periodic alternation in the rotation of most of the sunspots in the sun's two hemispheres, exactly as Hale has found to be the case.

Sunspots are so closely analogous to our cyclonic storms that each may be used to explain the other, and thus lead to a much better understanding of both.

Record Fabricating Job.—A record fabricating job was recently executed on the apartment house structure covering the block front on Madison Ave. between 70th and 71st Sts, New York City. This was accomplished by the Hay Foundry & Iron Co. for the Tishman Realty & Construction Co. The building is 11 stories in height. The steel work represented the assemblying of 9,762 pieces of steel and the driving of 36,200 rivets in the field. The plot occupied by the building is 30,000 sq ft. Approximately 2,200 tons of steel were used. The steel work was started Sept. 17 and the erection of steel completed Oct. 11, 1928.

City Officials' Day at Cleveland Convention

Important Reports to Be Presented and Discussed

THE city officials' division of the American Road Builders Association will hold its first annual meeting on Jan. 15, during the 26th annual convention and road show of the association. The division was organized June 8, 1928. Its aim is the standardization of city street and highway construction, maintenance and operation, including traffic regulation. At the meeting on Jan. 15 the various standards committees will present their reports as outlined below—the result of the year's work in each particular field. The city officials present will have the opportunity to discuss the reports, bring out such points as may be involved in their own particular problems and receive the benefit of the personal contact and experience of others.

Program for City Officials' Day.—The program announced for the city officials' day includes the following:

"Trend of City Government," Wm. R. Hopkins, City Manager, Cleveland, Ohio.—A subject presented by the able manager of a progressive city, whose growth and advancement have been phenomenal. This is an opportunity to learn how it was done from a man who will speak authoritatively on this subject.

Report of Committee on Administration, Organization and Finance; Chairman, H. C. Whitehurst, Assistant to Engineer - Commissioner, Washington, D. C.—It is the aim of this Committee to present clearly and logically the methods of administrating and financing city highway work. The report is based on a survey of present practice in more than sixty cities, selected as typical examples. These sixty cities were selected after information had been collected from 326 cities in 46 states and the District of Columbia. The report is informative and will be used as the groundwork for the future activities of this important committee.

Report of Committee on Design and Construction; Chairman, Geo. B. Sowers, Deputy Commissioner, Division, Engineering and Construction, Cleveland, Ohio.—The message of this report will be the need of standardizing and adopting by cities best present construction methods. It will include the principal types—asphalt, bituminous concrete, cement concrete, brick and block pavements. Important discussions of these pavement types will follow the committee report, led by persons who have made national surveys of each. Contrary to general belief, construction methods vary greatly, as does the selection of type for a specific class of traffic. The conclusions of this report, which are based on the summarization of present practice, will be of immense practical value to those who attend this session.

Report of Sub-Committee on Sub-Grades, Foundations and Bases for Pavements; Chairman, C. A. Hogentogler, Senior Highway Engineer, Bureau of Public Roads, United States Department of Agriculture, Washington, D. C.—The basic principles of success and failure in pavement foundations and subgrades will be discussed in this report, which is characterized by simplicity, directness and practical application. Few reliable sources of information have been overlooked by its author, who for many years has studied the perplexing problems of subgrade and foundation. To learn first hand the concise information contained in this report may mean the saving of thousands of dollars to those cities which can profit by the experiences of others.

Report of Committee on Maintenance; Chairman, C. E. Myers, Director of Transit, Philadelphia, Pa.—No subject is more important than maintenance. The report of this Committee, together with the selected discussions by city engineers of national prominence, will be of inestimable value to those who desire more information on the maintenance of city streets. Maintenance is an ever-present problem, which involves a wide variety of methods in modern practice. Some of these methods are good, others are better. A report on this subject, followed by open forum discussion, cannot fail to show those methods which have been found adequate through practical usage.

Report of Committee on Traffic; Chairman, M. O. Eldridge, Assistant Traffic Director, Washington, D. C.—The traffic problem is so serious that the United States Department of Commerce has codified recommended practice. This Committee report will present facts and conclusions which are drawn from the "Hoover Code" and other authentic sources of information. The importance of solving traffic problems is so vital to every city official that this report must be of unusual interest. The Chairman of this Committee, by his intimate contacts with the principal agencies which are attacking traffic problems, is especially qualified to present the situation. The conclusions of this report are not local in character, but embrace the entire United States. They will be of interest and usefulness to officials and manufacturers alike.

The Convention.—The 26th Annual Convention and Road Show of the American Road Builders Association which will be held Jan. 14-18 at Cleveland, O., will bring together the engineers and road builders from all over the United States and Canada, as well as from foreign countries, for the purpose of exchanging ideas on the most recent methods of highway construction, operation and maintenance. The program at the 1929 convention will consist of reports of committees identified with the several divisions, as well as reports and papers on subjects of general interest. These reports will constitute the year's work on the different subjects and will present the latest methods and standards.

The Road Show.—The exposition which is held in conjunction with the convention, is the largest demonstration of road-building machinery, materials and methods in the world. It makes available for personal inspection all the newest and most up-to-date equipment and materials used in the road-construction and maintenance field. Over 500 carloads of the latest developments in road building machinery, equipment and materials, comprising the world's largest road show, will be on exhibition at the Public Auditorium, Cleveland, O. The space available for the road show has been augmented by the addition of a new wing to the Public Auditorium and this building, together with the Central Armory, will make possible the display of a far greater number of exhibits than ever before—in all, there will be more than 200,000 sq. ft. of floor space occupied by exhibits of machinery, materials and equipment, the most complete and comprehensive exposition and demonstration of this type ever held at any time and any place.

The Convention will be officially opened by Colonel R. Keith Compton, President of the American Road Builders' Association. The delegates will be welcomed to Cleveland by the Mayor of that City, Honorable John D. Marshall.

Tuesday, as stated above, will be City Officials' Day; Wednesday will be County Highway Officials' Day and Thursday will be Pan American Day. On these days the various sessions of the convention will be devoted to the presentation of reports of committees, and papers and addresses, by engineers and officials prominent in the highway field. These reports and papers will deal with the construction, maintenance, operation and financing of roads and streets.

In addition to attending the meetings on Tuesday, city officials should not overlook the opportunities afforded at the sessions to be held on Wednesday and Thursday under the auspices of the Contractors, Engineers and Officials, County Highway Officials and Pan American divisions.

Asphalt Paving Methods Used in the City of Lancaster, Ohio

How New Pavement and Resurfacing are Handled

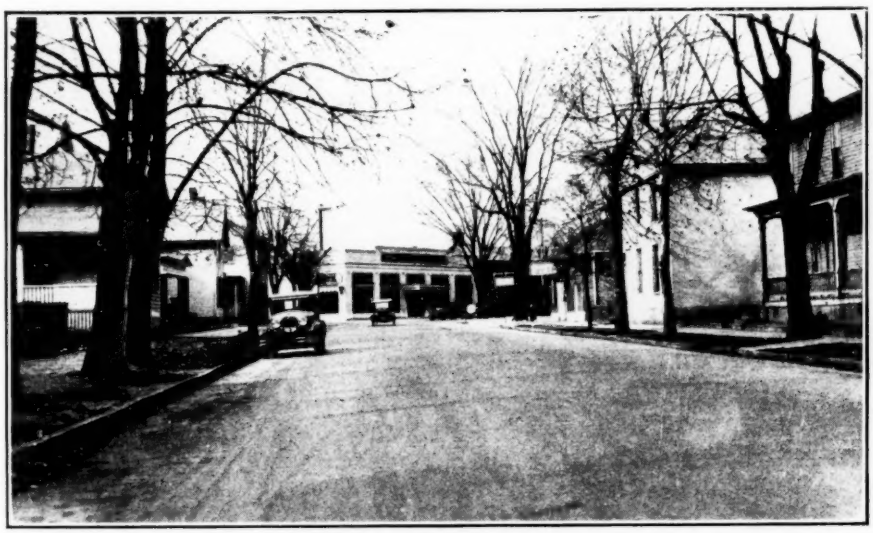
By WALTER W. GRAF
City Engineer, Lancaster, O.

THE slogan of the City Engineering Department of the city of Lancaster, O., is "Better Pavements Without Materially Increasing the Cost." In city paving work we are at a decided disadvantage when compared with state highway work on account of our many widths of streets, types of construction, manhole covers, valve boxes, existing improvements, street railway tracks, street intersections, different curb elevations and grades, etc.

Sub-Grading.—The first thing of importance in securing a good pavement is a uniform subgrade, which will insure us a uniform specified thickness of foundation and wearing surface. This can only be obtained by having the subgrade cut true and parallel to the wearing course. We are securing good results at a very small cost by making a light wooden template, cut to the contour of the street, with steel teeth set 2 ft. on centers across same so that the teeth will score the subgrade at its proper elevation when the template is resting on the curb and pulled along the street. This will cut the contractor's cost of fine grading, as no time is wasted in measuring and the most stupid workmen cannot go wrong. This not only cuts fine grading costs but insures a uniform thickness of foundation which is essential, as a foundation, like a chain, is no stronger than it weakest link.

The Base.—After the subgrade is cut to the proper contour and elevation, the next essential thing is to finish the concrete base parallel thereto. For finishing concrete base, we use a heavy wooden, steel shod, "strike off" template pulled by the mixer and follow this with a light wooden "tamping" template, cut to the contour of the street and operated by a man standing on each curb. This method will finish the base, with a few exceptions, without the use of hand floats. This method of finishing leaves a smooth surface which is roughened by the use of a wooden tamper 2 ft. in diameter with a coil of ⅝ in. cable attached so as to leave a print of the cable in the base. We find this to be a splendid method of preparing concrete base to receive sheet asphalt pavements. We believe that the more nearly perfect the contour of the concrete base the more nearly perfect will be the riding qualities of the finished asphalt surface. A perfect base not only gives the "rakers" a guide, but insures a uniform thickness of asphaltic wearing surface and therefore uniform compaction under the rollers. It has been hard to persuade either foreman or workman that a concrete foundation to be covered with asphalt, has any need to be true to contour. If there is a defect, "why not make it up in the binder," is the question asked. This leaves great variations in density and thickness with the resultant disagreeable waves in the surface. For these reasons, we check car concrete base with string lines at 8 ft. intervals behind the finishing template.

Pavement on First Court; 1 In. Binder, 1½ In. Top on 6 In. Concrete Base



Pavement on South Columbus St.; 1 In. Binder, 1½ In. Top Resurface Over Old Brick

Binder and Surface.—Where concrete base is finished as above specified, we find that more than 1 in. of binder is unnecessary and therefore always lay 1 in. binder on new work. On resurface work we find that it will require approximately an extra 100 lb. of binder to bring the old brick foundation up to the proper contour to receive a 1 in. binder. On resurface work, before any binder is laid we thoroughly clean the old brick street with water from a fire hose operating under a 100

lb. pressure. This not only cleans the foundation, but opens the interstices between the brick which insures perfect bond between the foundation and the binder. The binder course is inspected with a "straight edge" the same as the top and must show the same degree of smoothness. The top surface or wearing course, when laid must not vary from a 10 ft. straight edge more than ¼ in. This requirement, frequently and carefully checked by the inspector close behind the rakers, has the effect of creating a rivalry among these workmen and insures constant attention to one of the all important operations in the laying of a sheet asphalt pavement. With careful longitudinal raking and transverse luting with a 5 ft. wooden lute on a long handle followed by thorough longitudinal and cross rolling, this standard is not hard to attain and costs no more than work half done. Many otherwise well constructed pavements are condemned by the public on account of a rough surface. The citizenship judge a pavement by its surface smoothness and ease of riding.

For the past few years with the use of these simple and inexpensive methods, good washed sand and gravel, tested cement, stone, sand and asphalt, we have been able to sell the citizenship of Lancaster on asphalt streets where only six years ago the first asphalt pavement was laid. We have open specifications and have laid both oil and lake asphalts. For the past two years all asphalt streets in Lancaster have been laid by Brewer & Brewer Sons, Contractors, of Chillicothe, O., using Texaco asphalt.

Ohio Filtration Men Meet

The 8th annual meeting of operators, chemists and others interested in the filtration and water softening plants of Ohio, held at the Argonne Hotel, Lima, Nov. 1-2, drew a larger attendance than any previous conference, with about 100 registered. Practically all of the 58 filter plants and 21 water softening plants in the state were represented. In addition, representatives of several municipalities contemplating water supply improvements were present. After the meetings a visit was made to the Lima filtration plant and many also drove to Piqua to inspect the new water softening plant there.

Officials chosen for the coming year are: Chairman, C. T. Kaiser, Newark; vice-chairman, A. E. Hess, Alliance; secretary-treasurer, James M. Montgomery, Piqua. Other members of the executive committee are Frank S. Taylor of Defiance and J. H. Wenger of Westerville.

The conference favored Columbus for the 1929 session, but decision as to the place of meeting is left to the executive committee.

Short Courses for Sewage Plant Operators

Rutgers University, New Brunswick, N. J., is again offering short courses for sewage plant operators. These courses will be held Jan. 14-26 under the direction of the College of Engineering in co-operation with the New Jersey Sewage Works Association and the New Jersey State Board of Health.

This is the third consecutive year that these courses have been given and the attendance has been steadily increasing. The work of the courses is planned so that there is approximately 35 hours of laboratory work and 12 to 15 hours devoted to lectures and recitations. In addition there will be eight round-table discussions of various phases of plant operation.

Attendance to these courses has been largely from New Jersey although there have been many from outside states as far west as Ohio.

The purpose of the Rutgers Short Courses for Sewage Plant Operators is primarily to offer intensive training in the fundamentals of sewage disposal and sewage plant operation. It is an opportunity through which plant operators may better qualify themselves to solve their individual problems; to increase their general knowledge of sewage disposal and its relation to the public health and thereby enable them to discuss more intelligently, with the officers of their municipality the needs and necessary changes in their plants. Furthermore, it will afford opportunity for those men wishing to become operators, to qualify themselves to meet the requirements of the New Jersey State Board of Health for such positions.

The short courses will extend over a period of two weeks, beginning with registration on Monday, Jan. 14, and ending Friday afternoon, Jan. 25. Classes will be scheduled daily from 9 to 12 in the morning and from 1:30 to 4:30 in the afternoon and ending at noon on Saturday.

The courses are as follows:

Course I — Professor Lendall
Lectures and recitations—16 hours.
The elements of design and construction of different types of treatment plants—details of operation and maintenance.
Laboratory exercises—23 hours.
Prof. van der Meulen
Lectures and demonstrations by the instructor and actual determination and tests by the student. The work will cover the principles of chemistry as applied to sewage treatment, determination of solids, digestion of solids, hydrogen ion concentration, biochemical oxygen demand, sterilization and other phases of operation with which the operator is concerned.

Course II — Professor Lendall
Lectures and recitations—6 hours.
Comparison of the design of existing plants with operation data. This course is planned to show how details of design may be changed to improve operation and efficiency.
Laboratory—40 hours. Dr. Rudolfs
A continuation of Course I with more detailed study: the adjustment of the reaction of a tank by addition of lime, odors and their control, biochemical oxygen demand and Bacteriology. Some time will be given to water purification.

Course III—Sewage Plant Testing
Professor Lendall and Dr. Rudolfs
Lectures—6 hours. Laboratory—35 hours.
Methods for making extended tests on sewage plants. Sampling and preservation of samples. Analysis and interpretation. Measurement of stream flow and stream pollution.

The many problems of plant operation and design will be treated in informal discussions for which definite periods will be scheduled. These discussions will be led by men of experience and who are thoroughly acquainted with plant conditions in New Jersey and nearby states.

There are no educational requirements for admission to any of the courses.

Admission to Courses II and III will be based entirely on training and experience.

A nominal fee of $5 is charged for admission to any course.

Prof. H. N. Lendall is in charge of the courses and applications for enrollment may be obtained by addressing him at Rutgers University, New Brunswick, N. J.

Perils of British Streets

A deputation from the British National Safety First Association recently waited upon the minister of transport to ask for a full inquiry into the causes of street accidents, and to make suggestions with a view to reducing them, according to the London correspondent of The Journal of the American Medical Association.

"In 1922," the correspondent writes, "there were in Great Britain 2,728 fatal and 79,197 non-fatal accidents in the streets owing to vehicular movement. Last year the number rose to 5,329 fatal and 148,575 non-fatal. It is stated, however, that the rate is slackening in proportion to the number of motors and drivers licensed.

"Last year the vehicles most involved in fatal accidents were private cars and taxicabs, the proportion being 1,509, or more than a fourth of the whole. Motor vans and lorries, however, made a good second, with 1,104 fatalities. Motorcycles, which many regard as dangerous, were concerned in 784 fatal accidents. Motorbuses and coaches, which carry much of the heavy passenger traffic, figured in only 613, while horse-drawn vehicles were the cause of only 193.

"In London there were 293 street fatalities during the first three months of the current year, compared with 214 in the corresponding period last year. Excessive speed is declared to be the most fruitful cause of accident, though want of care or hesitation on the part of pedestrians is held to contribute to a great extent."

New York's First Printed Traffic Regulations.—New York's first printed traffic regulations were issued in 1903. Before that time the unwritten law of "keep to the right" was the only rule of the road.

How a Water Company Increases the Number of Its Customers

Mutual Benefit of Cooperation Between Utility and Plumbers

By NORMAN J. RADDER

AS a result of cooperation between the master plumbers of Indianapolis and the Indianapolis Water Co., more than 250 new customers have been added to the company's service list in the last six months.

For years Frank C. Jordan, Secretary of the Indianapolis Water Co., has had the idea that cooperation between the company and the plumbers would bring mutual benefits. He had some difficulty at first in making the plumbers see the point. Finally, however, they agreed to try it out.

Last spring, Mr. Jordan made out a list of the property owners in one section of the city who did not have running water in the home. In many cases they had a hydrant in the yard.

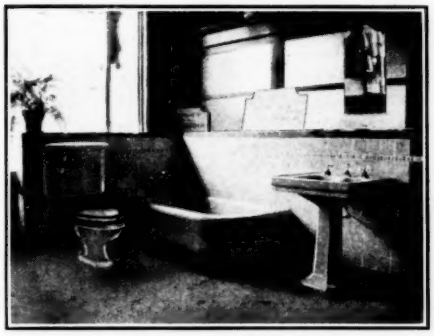
He turned this list over to G. T. Watson, Secretary of the Indianapolis Merchant Plumbers' Association, who worked up the list according to neighborhoods and then told his association members to get on the job.

They did and sold 250 complete bathroom outfits the average value of each being $250. Thus the plumbers made sales of $50,000 and the water company got 250 new customers.

In addition to giving plumbers the names of prospects, the water company has carried on an extensive advertising program in two of the Indianapolis daily papers and has also turned over much of its lobby space to a display of plumbing fixtures. These displays are installed by jobbers in Indianapolis and are changed frequently. Just recently Mr. Jordan called attention to the fact that more of the lobby space should be used for this purpose.

"I have to keep after the dealers all the time to keep leaflets descriptive of the equipment here to be picked up by the 50,000 customers who pass through the lobby each month to pay their water bills," says Mr. Jordan. "The people who came here are the best possible prospects for additional plumbing fixtures. We are glad to give the plumbers the opportunity to put equipment in the lobby, because if it helps them it gradually gets around to help us. We are anxious to sell more equipment to the home owner who has only a kitchen sink."

One corner of the lobby of the office of the Water Company has a most attractive display of a complete bathroom in a delicate shade of lavender with chromium fittings. A recessed tub is in the corner with a pedestal lavatory on one side and a toilet on the other.



Bathroom Equipment on Display in Lobby of Indianapolis Water Co.

View of Portion of Lobby of Indianapolis Water Co.

There is an attractive tile background. In another part of the lobby is a pedestal lavatory in a soft yellow shade, while across the lobby is a wall hung lavatory in green hung to a standard than can be moved around the room.

Mr. Jordan conceived the idea years ago that plumbers ought to sell equipment on the partial payment plan. It was only within the last year that he obtained general acceptance of the idea. No doubt it was the fact that plumbing equipment could be obtained on easy time payment that enabled plumbers to sell 250 bathroom outfits.

A few years ago, the Public Utilities Commission authorized the local water company to install meters in every building in the city of Indianapolis and they have been gradually enforcing this rule. Recently the water company decided to take different sections of the city and notify every user in that district that it was compulsory to install meters by a certain date.

Mr. Jordan, realizing the possibilities that such a situation offered to the plumbers, called in the officials of the Master Plumbers' Association, and together outlined a plan whereby a duplicate of a certain number of the notices sent out was given to the plumbers in the different districts with the understanding that it was not just for the small job of making the meter connection, but for the opportunity of selling these people some more plumbing work and especially the opportunity of being in the home and able to see what these prospects really needed.

The advertisements which the water company runs in the Indianapolis papers are educational and talk about the modernizing of property with sanitary plumbing, a higher standard of living, running water in the home, etc. They all end with the phrase "Consult your plumber" and point out that Indianapolis plumbers will sell fixtures on the partial payment plan.

Baltimore's Pier System Worthwhile Revenue Producer

Baltimore's great system of piers, known as Nos. 1, 2, 3, 4, 5 and 6 Pratt Street, are producing a worthwhile revenue, according to the Municipal Journal.

Under the supervision of the City Comptroller the city leases space on these piers at 42 cents a square foot per year. The total surface of the combined piers is 1,185,379 sq. ft. The combined length of all these piers, if placed end to end, would be 6,888 ft.

Prior to the great fire of 1904 the city owned but little wharf property of importance. The fire made it possible to acquire all of the burnt district fronting on the harbor (about 4,000 linear feet), and under the Six Million Dollar Loan the city purchased the property and removed all buildings streets, etc., and laid out a system of public wharves and docks south from Pratt Street, which has been made 120 ft. wide, with many streets running into same, also widened and improved. The public wharves and docks situated in the upper harbor are intended for coastwise, bay trade and market boats. The market boats come in at Pier No. 4, Pratt Street, or Long Dock, as it is commonly known, which is at the foot of Market Place and within a stone's throw of the Wholesale and Fish Markets.

Tenants occupy most of the space on these piers, but that part which is not leased is used for storage purposes for lumber, etc. In one year the wholesale lumber merchants handled over 70,000,000 ft. of lumber on the Municipal Piers and paid the city about $75,000 for this privilege alone.

Service Connections

Placed in Advance of Street Improvements

SOME interesting information regarding the experiences of Indiana cities in constructing service connections before a permanent pavement is laid, was brought out at a meeting last spring at the Indiana Section of the American Water Works Association. The notes following are taken from the November Journal of the Association.

Muncie.—We have not been very successful in our city in having the cooperation of the board of public works in helping us to complete service connections before permanent paving is done. Where it is necessary, we put these services in and try to collect from the property owner. In most cases we can collect, but there are a good many cases where we cannot. Where we collect from the property owner we put an account in our ledger and keep under this account the costs of the material, labor, etc., as a credit on our ledger. When the service is put in he is permitted to use that much water before he is made any charge. That seems to be the only way we can do it, but it is awfully difficult to do. The connections must be put in before the streets are paved and if the property owner does not pay it, it is handled as a lien and collected just as any other lien is collected.

Evansville.—We install services and charge the immediate property owner for these services. If they do not pay it, we add it to the tax assessments.

Kokomo.—We have a city ordinance providing if the city is to put in the paving we make a survey and furnish the city engineer and contractor who has the work a list of the lot numbers and sizes of service we think should go to the lot. This amount of money is added to the assessment roll. The contractor advances the money to us before he starts to work. The contractor pays us for the estimated amount of services and this is added to the assessment. When the service is used we refund to the consumer. We collect for ½ in. service, $25.00 and for ¾ in. $32.00. We carry these funds under an account listed as "Service Deposit" in the ledger, we can take off a trial balance at any time.

Evansville.—On non-improved streets we charge $10.00 for the service. This amount is charged to the contractor who puts in the street. He takes it over to the county or city clerk who takes it to the Board of Works. They add a charge of $1.00 to the charge we made and add it to the assessment roll. The charge then corresponds with our books.

Do you refund that to the consumer when he takes service?

Evansville. — No. For improved streets we charge $25.00, brick streets $15.00 and for unimproved dirt streets, $15.00.

Richmond.—For a number of years through the cooperation of the Board of Works, when a permanent improvement is to be made, the city engineer notifies the property owner that gas, sewer, and water must be installed. He indicates where the water taps are to be made and notifies the water company where the services are to be located. The record is sent to the Board of Works, added to the list of assessments of the property owners, in the city treasurer's account, and the water company is reimbursed for the actual cost of services. The water company has to lay all services to the curb, except in this case. After the owner makes application for water, the company refunds the cost of those services to the curb. There is no revenue until the service becomes revenue-producing. We refund the actual cost at the time it is put into service.

Evansville.—When you figure actual expense of refunding you are figuring overhead in general office, etc. Can you figure overhead in ledger and journal entries and construction? I do not see how you can figure insurance and time of making ledger entries, etc.

Richmond.—We add 10 per cent to the cost.

Lafayette.—We have an ordinance to cover this matter. We proceed in this manner: We require on applications for water the advance sum of $30.00. This $30.00 becomes a rebate in water rent until it is used up. We proceed in this manner on hard surfaced streets. We place the regular ⅝ in. service to the edge of the lot. We notify that the service has been put in. We give a description of the service and when the property becomes a consumer, they get credit for water rent to the amount of $30.00. We get along very nicely. Most of them are glad to know they have water when they come to sell the lot. If it is not paid we certify it to the Board of Works and in that way to the city treasurer, showing a lien on this property. It becomes a refund in watre rent later if it is not put in use for ten or twenty years. We could charge 6 per cent on these deferred payments, but we have not carried this out yet. The Acts of 1927 require platted ground to put in these services.

Evansville.—We charge $10.00 a service for unimproved dirt streets, $15.00 brick improvement, and $25.00 for asphalt before these services are installed. We do the best we can. We send postal cards, as a great many of these people live out of town.

Lafayette.—We do not call it charge; an advance is what it really is. We send a letter stating that it is payable by a certain time. If they fail to pay it, we certify it to the Board of Works, Controller and City Treasurer. When they come to pay the taxes the Treasurer informs them that water has been put in and that we require the payment of $30.00 from each applicant. We go ahead and do this and notify the owner it has been done. Very few unpaid services are put in on account of the hard paved streets.

Evansville.—If you would make a charge of so much to each property owner regardless of whether on the near or far side of the street for each service installed on the property, you would eliminate a great deal of trouble.

Richmond.—A uniform charge would be very desirable. That matter was taken up before the Commission. It seemed fair to make the same charge to the property owner on either side of the street. They said, "No." They said "you must make it the actual cost. The short side of the street has the advantage."

Evansville.—It would hardly be fair, if you spent $8.00 for a short service, to charge $18.00. I think you should bear that cost. If you buy a lot, you do not go down to the Board of Works to find out on which side of the street, far or near, the gas or water main is. Why should not the owners on either side of the street pay the same price?

Columbia City.—We are going ahead and making service taps, putting in the work and material at cost. We give the property owner 30 to 60 days to pay. We have never had any trouble in collecting our accounts. We make no refund whatever. It is a publicly owned plant. The property owner takes care of his service from the main to the curb and into the house. Everything is satisfactory. The water company, municipal or private, should run the service to the curb free to the consumer. They would have to rebate to every consumer from the main line to the curb, the cost of the labor and material. Of course, it is more on the long side of the street for labor and material. We do not aim to make any profit. We charge just what it costs. If we pay labor 40 ct. an hour, we charge the consumer 40 ct. an hour, and material the same. We keep that cost down as low as possible and we have no trouble.

Richmond.—Our company does not consider the 10 per cent profit. The 10 per cent is to cover insurance, superintendence, and legitimate additions to the cost. It is not a profit. It is incidental and intangible.

City Swimming Pools of Baltimore, Md.

According to a recently issued report of the Board of Park Commissioners of Baltimore, Md., the average yearly receipts of the Municipal swimming pools for the period of 1918-1928 amounted to $29,830. The investment in swimming pools is $900,000, not including the recently opened bathing beach at Fort Smallwood Park. The total number of patrons in 1928 was 498,665 and the average daily attendance at six pools was 6,472. The average daily cost of operation of the pools was $419.77 and the average daily reecipts were $567.86.

What's the Construction Outlook in the Municipal Field for 1929

Symposium of Opinions from Consulting Engineers Indicate an Active Season

Municipal Bridges for 1929

THE coming year promises to be one of unusual activity in the field of municipal bridges. The continued growth in motor vehicle traffic is rendering existing crossing facilities inadequate, and new bridges are being demanded to supersede ferries or to supplement existing spans. The newer structures are generally of larger magnitude to meet the requirements of greater traffic capacity and more generous navigation clearances. In many instances municipalities are now demanding long-span high-level bridges where low-level movable spans have heretofore prevailed; the desire to avoid traffic interruptions and delays, rather than maritime requirements, is the governing motive. Individual bridges of today represent much larger investments than those of the past. Everything in this field of construction is now being done on a larger scale. The recent rapid development of privately built toll bridges to meet the needs of vehicular traffic has apparently stimulated municipal interest and activity in bridge construction. The entire nation has become "bridge-minded."

In all parts of the country, cities and counties are voting large bond issues or are otherwise projecting bridge undertakings of magnitude. In the Northwest, large bridges have been voted or are being promoted in Portland, Seattle, and Tacoma. San Francisco is seeking authority to build a structure of unusual magnitude across the bay to Oakland or Alameda. In the Middle West, large municipal bridge projects are in various stages of advancement in Louisville, Cleveland and Toledo. In the East, municipal bridge projects of magnitude are under study or construction at New York, Providence, Norfolk, Knoxville, and Albany.

In the newer bridges planned for municipalities, more consideration is being paid to artistic development of the design. The technical problems of stresses and strains have long ago been surmounted, and the designers are freer to devote their attention to studies of form and proportions. Pleasing appearance is sought, not by extraneous embellishments but by development of the most effective lines and harmonious proportions in the essential elements of the structure.

American cities are now voting many millions of dollars annually for new bridges. These are being planned on the basis of comprehensive city planning studies and traffic surveys. They are being built to afford needed traffic outlets, to by-pass and relieve congestion, and to develop new areas of population or industry. The public takes a wholesome interest and pride in each project as an expression of the spirit of enterprise and achievement of the community.

ROBINSON & STEINMAN,
117 Liberty Street,
New York, N. Y.

Prospects Bright in Chicago District

Prospects for municipal construction under our supervision for 1929 are healthy. Underground improvements probably will approximate the 1928 volume; while that of paving and street lighting may exceed it. Our 1929 construction in the Chicago Metropolitan district will probably reach $5,000,000; in the Kentucky district $1,000,000; in the Central Wisconsin district, $1,000,000 and in the St. Louis district $1,500,000. A large portion of the work in the Chicago, St. Louis and Central Wisconsin districts consist of water filtration and sewage disposal plants.

CONSOER, OLDER & QUINLAN,
205 West Wacker Drive,
Chicago, Illinois.

Future Prospects Attractive in New York

The prospect for engineering work in the municipal field for 1929 appears unusually attractive. The writer as consulting engineer in conjunction with Whitman, Requardt & Smith, Engineers, is engaged in the construction of a new gravity water supply system for the city of Albany, at an estimated cost of about $9,000,000. The village of Herkimer, N. Y., has just let contract for the construction of a new gravity water supply, from plans prepared by the writer some years ago.

Various other projects are in hand or appearing on the horizon and the indications are that continued prosperity and industrial growth will demand and provide the necessary means for municipal improvements, particularly in connection with water supply and sewage disposal.

ROBERT E. HORTON,
Voorheesville,
Albany County, N. Y.

Expects Sanitary Refuse Disposal Projects

The prospectus of work in the municipal field seems fairly bright in northern New Jersey. The rapid progress of the construction of the Hudson River bridge has indeed hastened the highway building program in Bergen and adjoining counties. Scientifically planned developments like the "Motorage" city of Radburn, between Hackensack and Paterson, progressive townships Teaneck, Englewood, etc., are bound to keep pace with the rapid growth of the communities as far as sewer and street programs are concerned. There is all reason to believe that Teterboro and other airports will see vast improvements in the course of the coming year.

The Bergen County Chamber of Commerce, local chambers, businessmen's associations, service clubs and civic bodies are keenly interested in these questions as well as in the development of a state wide park system.

I have done, personally, a good bit of missionary work during the last few years spreading the gospel of sanitary refuse collection and disposal in properly designed and operated incinerators. Various communities of this district are talking incinerators, several have appropriations and it is to be hoped that the new year will see several incinerator projects materialize.

JOHN H. LIEBAU, R. A.,
328 Main St.,
Hackensack, N. J.

Big Improvements in Offing

A great many projects of magnitude, particularly with reference to sewerage systems, sewage treatment works, water works, and extensive drainage programs, have been investigated, reported on, and designed during the past year.

While there is a difference of opinion concerning the effect of a presidential year on business generally, I am convinced that engineering projects proposed for execution under political or semi-political direction have been effected. In some cases the contracts are awarded for whatever may appear advantageous to the public. In other instances a retarding effect is produced; presumably with the thought that agitation for or against might be considered detrimental to public policy.

In reviewing my practice and taking into consideration the prepared data on

extensive engineering works, I can, without any great degree of optimism, predict that the coming year will see an active construction program started. Many changes are taking place in the Metropolitan zone and huge engineering undertakings are under way. The compelling factor expediting these huge projects is—dire necessary.

Many of the contracts with which I am intimately associated are waiting the starting or completion of bridges, tunnels, and transportation facilities; and, reflecting on the development of the past year, it appears that 1929 will usher in an awakening for many of the apparently dormant projects.

THOMAS F. BOWE,
110 Williams St.,
New York City.

Prospects Bright for Hydraulic Construction

The outlook for 1929 is very encouraging in view of the fact that we have, as a nucleus, at the present time the completion of the plans and specifications for an additional water works station for the City of Erie to include an intake line from the lake, a low service pumping station, a filtration plant, a high service pumping station and connecting force mains designed for an ultimate capacity of 48 million gallons per day, of which 16 million gallons will be installed in 1929 at a cost of approximately $1,500,000. This will give the City of Erie, upon completion of these works, a total capacity of 48 million gallons per day, and ultimately 80 m. g. d. In addition to the water works, a sewage disposal plant has been designed for the City of Erie, the construction of which will proceed early in 1929. This plant was designed for a capacity of 40 million gallons per day. The project will include also the main interceptor leading to the sewage disposal plant and the construction of an open concrete channel for Mill Creek which will be straightened out through the site of the sewage disposal plant. The great majority of the intercepting sewers and overflow works was completed recently from plans prepared in this office. The cost of the interceptors, so far completed, has been in excess of $1,000,000.

Ninteen twenty-nine will see the completion of an extensive and comprehensive program of water works development designed by this firm for the City of Nashville, Tenn., when the 28 m. g. d. filtration plant of the city will go into operation. Likewise, the new water works of the City of Bowling Green, Kentucky and sewage disposal plant and sewerage system involving more than 20 miles of sewers for the City of New Lexington, Ohio; the softening plant at Fostoria; the sewage disposal plant for the Torrance State Hospital at Torrance, Pa.; the new water works and softening plant of the Borough of Sewickley; additions to the water works and electric power plant of the Borough of Etna, Pa.; the concrete arch impounding dam of the City of Norton, Virginia, and the reservoir improvements at Newport, Kentucky, will be completed in 1929. A new pumping station and filtration plant for the City of Lockport, N. Y., costing approximately $500,000, will be started early in 1929 as contracts for this work have already been let. Contracts for a garbage incinerating plant and substantial additions to the sewage disposal plant of the City of Greenville, Pa., will be let early in 1929 from plans already completed.

In addition to the above there are a number of other projects, one of considerable size and the rest somewhat smaller, which are in the course of preliminary studies and it is possible that the greater portion of this work will proceed to construction in 1929.

In general, the outlook for 1929 in our field and in general municipal improvements, such as roads, bridges, public institutions, etc., is very promising and we are rather optimistic.

THE J. N. CHESTER ENGINEERS,
Clark Building,
Pittsburgh, Pa.

Outlook for Municipal Construction Work

Due to a general slump of business in 1927, the percentage of taxes collected in the smaller municipalities surrounding Detroit was quite small. As a consequence the amount of municipal construction was smaller than usual, however, factories have been running full blast in 1928 and the tax payer has more money and will be more inclined to request improvements for 1929.

It is my belief therefore that there will be a considerable volume of sewer and water construction done in those villages that require such improvements with an increase in the amount of paving laid where sewers and water have already been installed.

HARRY L. HUDSON,
Broadway Exchange Bldg.,
Detroit, Mich.

Ohio District Has Good Outlook

The outlook for work in the municipal field for 1929 in this section of the country looks to be very good.

Many Ohio municipalities voted favorably on bond issues at the past November election and considerable work in the sewerage and water works fields undoubtedly will be started this coming year.

H. P. JONES & COMPANY,
1601-8 Second National Bank Bldg.,
Toledo, Ohio.

Parkway Improvements Along Hudson

In Westchester County, New York, several important projects under construction will be completed, work on new ones started and important projects for the future developed during the year 1929. Some of these in the eastern section of the county are the new Saw Mill River parkway, Cross County parkway, repavement and improvement of existing highways and streets and elimination of railroad grade crossings. New projects for which surveys, plans and financing are to be developed are the Hudson Riverside driveway, sewers and disposal plants.

The Westchester County Parkway Commission's construction program for 1929 includes the Saw Mill River parkway and the Cross County parkway. The Saw Mill River parkway is in a valley about a mile from and parallel to the Hudson River, and to extend from Yonkers about 7.5 miles northward to Elmsford; it will handle considerable north and south traffic of this section of the county. This is to be opened to traffic as far as Ardsley in the fall of 1929. Most of the grading, drainage and bridges have been completed, the remaining work consists of paving a 40-ft. driveway, landscape, grading, planting, lighting and paths from Tuckahoe Road, Yonkers, through Hastings-on-Hudson to Ardsley a distance of 4.1 miles at an estimated cost of $896,000, and grading, drainage and bridges for a continuation of the driveway from Ardsley to Elmsford a distance of 3.4 miles at an estimated cost of $594,000. The Cross County parkway work will include grading, drainage and bridges from Valentine Avenue, Yonkers, eastward to the recently opened Hutchinson River Parkway at California Park, a distance of 4.1 miles at an estimated cost of $1,692,000.

The Ravensdale-Jackson Avenue improvement in Hastings-on-Hudson and the Town of Greenburgh will be started in the spring. The work will include the elimination of the railroad grade crossing of the New York Central Railroad, Putnam Division at Ravensdale Road and the repaving and improvement of Ravensdale road and Jackson Avenue from Farragut Avenue eastward, across Saw Mill River parkway to Central Avenue. This is a cross county highway the improvement of which is essential for the execution of prospective local developments and needed in this part of the county. The grade crossing elimination is to be completed by the fall which will permit progress to be made upon the county improvement of the highway.

Warburton Avenue-Broadway improvement in Hastings-on-Hudson. Warburton Avenue is west of and parallel to Broadway, connecting to Broadway at the northern end and

when improved will relieve traffic congestion of Broadway. It is more direct with fewer hills and affords attractive views of the Hudson River for miles and of the Palisades on the opposite of the river. The survey has been made and repaving work is to begin in the spring starting at the Yonkers line. The type of pavement is to be decided by joint conference of village and county authorities.

The proposed Hudson Riverside driveway has been surveyed from Van Cortlandt Park, New York, to Kingsland Point and the Westchester County Board of Supervisors announced an estimated cost of the project as $34,000,000. The communities along the Hudson are endorsing this project and endeavoring to arrive at a solution of the financial problem. State aid has been discussed for the financing, being a large amount for the county to handle and the highway would be more of the nature of a state highway.

In the villages of Dobbs Ferry and Hastings extensive programs of street improvements have been carried out through 1928 and will be continued in 1929. Problems confronting the municipalities in the eastern area of the county are the early solution of the matters of sewers and disposal plants. With the continuously increasing population the present sewer systems will soon become inadequate necessitating intelligent planning now, for the immediate as well as distant future. A trunk sewer in the Saw Mill River valley, a disposal plant in the vicinity of Yonkers and an incinerator in the Town of Greenburg are projects for which plans and financing are being considered. The elimination of all telegraph and lighing poles from the main streets of Dobbs Ferry and other villages is contemplated also improvement in illumination and ornamental street lighting fixtures, including Dobbs Ferry and Hastings-on-Hudson. The Edwin Gould playground in Dobbs Ferry will be completed in 1929.

The crossing of parkways and highways with intersecting thoroughfares are generally planned and constructed on new developments to avoid crossings on the same grade by means of bridges and tunnels, as a permanent means of facilitating traffic and insuring safety at a minimum of maintenance cost. However some existing parkways and highways and also new projects have crossings at same grade which might have been easily avoided originally and plans may be developed for the elimination of some of these highway grade crossings. These grade crossings retard speed of traffic, require maintenance and operation of traffic control signals and constant supervision of traffic officers and, notwithstanding precautions for safety, they are a continuous hazard. Who should stand the expense of the maintenance of traffic control at such crossings is a frequent controversy. More attention and effort to avoid and eliminate highway grade crossings as well as railroad grade crossings should be made. This can be accomplished during original planning and construction with less expense than after completion of construction.

There are several railroad grade crossings of the New York Central Railroad, Putnam Division, in the Saw Mill River valley. Some of these are to be eliminated and the elimination of others have been considered. A bridge over the tracks at Nepperhan Road, Yonkers, is under construction eliminating this grade crossing and is to be completed in the spring and the bridge at Ravensdale to be completed in the fall will eliminate that one. It is expected that plans for elimination at other places will be consummated to remove the constant menace of such crossings.

Highway construction work in Westchester County will amount to about $8,000,000. In 1929 practically all projects of which have been officially approved; this includes State, County and Town work. Eight railroad grade crossings are included in the 1929 program and the construction cost of these structures may be about $2,000,000.

H. W. SCHARF,
83 Cliff St.,
Hastings-on-Hudson, N. Y.

Buffalo Vicinity to Compare Favorably with 1928

Street paving for the coming year, of which the largest percentage will be sheet asphalt on concrete base, will about equal that of 1928. The completion of bridges over Buffalo River and Cazenovia Creek will open the important thoroughfare of Bailey Ave. to traffic for its entire length. Just outside of the city line, the construction of a few short gaps of road will complete the outer loop of the Greater Motorways System, providing a detour to points south, east and north of the city without entering the city at any point. The new Southwestern Boulevard, about thirty miles long, will be about half finished. This is a 40-ft. road over entirely new right of way and parallels the present Lake Shore Highway about two miles south. Where it crosses Eighteen Mile Creek, the largest concrete arch highway bridge in this part of the state is being built.

Half a mile of Outer Harbor concrete dock wall is planned, which will enable the city to finish the grading for a large waterfront park. The remaining six hundred feet of concrete bulkhead required to complete the Niagara River side of Bird Island pier also is scheduled for construction. Dredging of Erie Basin will continue.

The fourteen hundred feet of Cornelius Creek drain, a 7 ft. x 10 ft. reinforced concrete overflow sewer, will be finished. Preliminary studies for a sewage disposal system for the entire city are well under way.

The new $14,000,000 Curtiss Street passenger terminal of the New York Central Railroad will be ready to use about May 1st. Plans for the new downtown passenger station of the same railroad will be ready so that work on this project should start soon after the Curtiss Street station is opened. Under the jurisdiction of the Grade Crossing and Terminal Commission, work on the Amherst-Austin Street grade crossing elimination, at a cost of about $3,000,000 will be started in a short time.

Bids will be called for on the new $6,000,000 city hall early in 1929 and work on the new State Teachers' College buildings and the state office building will also start early in the coming year.

CUTHBERT E. REEVES,
Liberty Bank Bldg.,
Buffalo, N. Y.

Expect Average Year

It is extremely difficult to make a reasonable estimate of the outlook for municipal engineering work likely to be undertaken in 1929 other than that handled directly by city engineers. From present indications, however, it is our impression that the amount of work which we are likely to handle will approximate the average of the past 4 or 5 years. It does not appear likely that there will be abnormal activity nor that there will be an especially small amount of work to be handled. It is our impression that 1929 may probably be expected to be an average year.

METCALF & EDDY,
Statler Bldg.,
Boston, Mass.

Southern District Prospects Optimistic

The indications are that there will be more than an average amount of municipal work such as waterworks, sewers, sewage disposal plants and street paving, in Oklahoma and Texas in 1929. A great many municipalities have mapped out programs for these improvements for which bonds should be voted or funds provided early in the year. It is our opinion that 1929 will show greater progress than this year.

BENHAM ENGINEERING CO.,
Perrine Building,
Oklahoma City, Okla.

Predicts Good Year in 1929

Indications are that 1929 will be a good construction year in water works and sewerage projects.

BARKER & WHEELER,
36 State Street,
Albany, N. Y.

Hydraulic Construction Expected to Be Active

Judging from work under way in our office, which is likely to go into construction the coming year, we are of the opinion that water supply, sewerage and sewage disposal for 1929 will be very active.

More large projects are now in prospect for starting construction next year than in any prior year. Construction prices apparently will be somewhat higher than in the last year or two.

As we specialize mainly in water supply, sewerage, sewage disposal and flood relief, we are only competent to express our opinion along those lines and those we believe will be active.

ALVORD, BURDICK & HOWSON,
8 So. Dearborn St.,
Chicago, Ill.

Immediate Prospects Not So Good

There does not appear to be a great deal of work in immediate prospect, but for municipal work there is needed construction in connection both with the city sewage system and its water works, the water works being more in the nature of extensions rather than improvements to filter plants and pumping stations. Also, it is expected that work will be started during the coming year on a bridge across the Delaware River connecting Burlington and Bristol, but this is a private enterprise though it involves street changes as well as the construction of the bridge itself.

CONRAD & BUSBY,
321 High Street,
Burlington, N. J.

Considers Prospects Good

An examination of the prospects in the municipal field, for engineering construction, seems to indicate that 1929 should prove a good average year. The slump in real estate activities together with a weak market for municipal bonds during 1928 resulted in the postponement and withdrawal of a considerable volume of work. National and local elections also have had their effect. However, with the election over and general business in excellent condition in the Chicago district, we are looking forward to an increase over last year's business.

KELKER, DE LEUW & CO.,
11 West Washington St.,
Chicago, Ill.

Patzig Expects Greater Activity

Municipal work in this territory for 1929 at this particular time looks normal. It has repeatedly been our experience that judging future conditions at this time of the year is difficult to do. Present rumors, however, indicate a little greater activity towards municipal construction than they did a year ago. Our business and agricultural conditions are better, so one feels justified in expecting a greater amount of construction work.

PATZIG TESTING LABORATORIES,
210 Eleventh St., Des Moines, Ia.

Mulholland Retires

Editorial in Nov. 15 Los Angeles Times.

Los Angeles owes more to William Mulholland, whose retirement as chief engineer of the Water Bureau has just been announced, than to any other one individual who has ever been associated with its service. For fifty years continuously he has labored to perfect the Los Angeles water system, and for twenty-six years has been its chief engineer. He will be long remembered as the builder of the Los Angeles Aqueduct, the boldest and most spectacular engineering work ever attempted by an American city, as well as one of the most difficult.

During his term of service the Los Angeles water system from a few miles of pipes valued at most at $100,000 has grown to a system of 3,200 miles of conduit worth at least $100,000,000, and supplying 285,000 homes, buildings and factories over an area of 440 square miles. The tribute paid to him by Commissioner Del Valle may well be quoted in part:

"He has ever regarded the duty of keeping the people supplied with water as sacred and inviolable. Many a time has this city been saved from actual shortage by the sleepless vigilance of this one man. Domestic use has been maintained; municipal needs have been met, and the public health, dependent at all times upon a pure and potable water supply, has been conserved.

"It may be asserted without fear of successful contradiction that no engineering achievement in this country within the past half-century has exceeded in difficulty or merit that of William Mulholland in keeping the water supply of this city, in its rapid growth and development, up to the requirements of its inhabitants.

"Despite his years and long service, he is still a vigorous and outstanding figure in the community, strong in the affection and esteem of his fellow-citizens. No ill fortune has been sufficient to shake the confidence of the people in this good and faithful servant."

Mr. Mulholland leaves office upon the eve of a still more difficult and costly achievement, the Colorado River aqueduct, but not without having laid a firm foundation upon which his successors can build. The preliminary planning of this great enterprise has been done under his watchful eye, and the city has in his probable successor, Assistant Chief Engineer Van Norman, a man of proved capacity upon whom it may rely to solve the further problems that will arise. Van Norman has had twenty years of service in the Water Department and was a division chief in the aqueduct work. Loaned to the city a few years ago to construct the outfall sewer, he built it in record time and at a saving of $5,000,000 from its estimated cost.

So that if the city suffers the loss of a tried and trusted adviser in Mr. Mulholland's retireemnt, at least he leaves to take up his work a man trained in his own school of rugged honesty and spirit of service to the community. The Water Department has, it is understood, a tentative plan of retaining Mr. Mulholland in an advisory capacity, and it is to be hoped that he can be persuaded to accept such a relationship.

It is difficult to imagine the Water Department without William Mulholland.

Transactions of the Eighth Annual Conference of State Sanitary Engineers, 1927

Public Health Bulletin No. 183, recently released, contains the transactions of the Eighth Annual Conference of State Sanitary Engineers. A number of committee reports in this publication are of general interest. The report of the Joint Committee of the Conference and the American Public Health Association setting forth the final standards for swimming pools and bathing places will have widespread application and should prove to be very helpful to all persons interested in the design, operation, and sanitation of swimming pools. The report of the committee on sewage treatment gives an interesting résumé of the progress being made in Ohio to obtain careful and scientific operation of sewage-treatment plants.

New England City Managers Organize Association.—City managers of Connecticut, Maine, Massachusetts, and Vermont have organized the New England City Managers' Association, to be composed of city and town managers in those four states. The following officers were elected at the first meeting:

President — C. A. Bingham, city manager, Norwood, Massachusetts, and formerly manager of West Palm Beach, Florida.

Vice-president—James E. Barlowe, city manager, Portland, Maine.

Secretary—Roy M. Wilcomb, city manager, Springfield, Vermont.

This association will hold quarterly meetings each year, one in each of the states.

Methods of Sludge Disposal for Small Sewage Plants

Seven Ways of Preventing Sludge Accumulation at Plants

By FRANK BACHMANN
Sanitary Engineer, The Dorr Co., Chicago, Ill.

THIS discussion deals with the disposal of sludge from septic tanks, Imhoff tanks and separate sludge digestion tanks which are in common use throughout the country.

Methods of Disposal.—The following methods of disposal of digested sludge from all types of tanks are in common use:

1. Discharge into stream during flood flows.
2. Lagoons.
3. Filling in low lands.
4. Direct onto land and ploughed in.
5. Dried on prepared sand beds.
6. Dried sludge used as fill.
7. Dried sludge used as fertilizer.

The first five methods refer to wet sludge as discharged from the tanks and the last two to the disposal of air dried sludge.

Discharge into Streams. — Many plants both large and small make use of streams during flood conditions to dispose of their sludge. This procedure is usually not approved by the state board of health but there are instances where no harm is done by this method, especially where the streams are large and the sludge is discharged at the proper time. In most cases. however, evidence of sludge along banks of stream, on vegetation and deposits in the stream itself are noticeable for some time after the discharge of the sludge. As a general practice this method of disposing of sludge is condemned as being unfair to the inhabitants below and in its unreliability because of the uncertainty of the duration of flood conditions. This method is used more in connection with septic tanks which are pumped clean periodically than with any other type of tank, although the sludge from a few Imhoff tank installations is disposed of in this manner.

Much has been written on the disposal of sludge from the larger sewage plants throughout the country where technical supervision is available but little has been said of this problem for the smaller plants. In Ohio, for instance, 80 per cent of the sewage plants serve populations of less than 7,500 people and this percentage is, no doubt, exceeded in some of the western states. The disposal of sludge from the smaller plants is, therefore, of interest to a large number of city officials and operators, and we accordingly are reprinting below an interesting paper on this subject which was presented last November at the Iowa Sewage Treatment Conference.

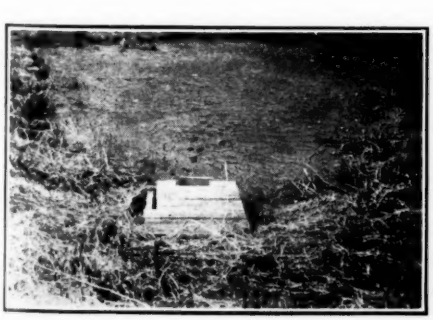
Along the seaboard it is quite customary to pump the sludge into the ocean during winter months when there is no bathing. Reports indicate that no harm results with this procedure.

Lagooning Sewage.—Lagooning of sludge is not common in the smaller plants. Lagoons, where used, consist of natural or artificial holes in the ground and are usually in sets of two or more for flexibility. Lagoons are from 3 to 10 ft. deep and sludge is run into them until they fill up, after which the sludge is allowed to drain and then is hauled away. Lagoons serve their purpose satisfactorily if they receive a well digested sludge but with a raw or partially digested sludge they usually smell badly. Aside from an odor nuisance lagoons are a source of mosquito and fly breeding. There are very few lagoons being installed today for disposal of sludge because of the objections mentioned.

Filling in Low Land.—Where low land is available sludge has been disposed of with satisfactory results by using it to fill in this low land. This is usually only a temporary expedient as other methods must be used when the fill is completed.

Disposal into Land and Plowing In. —Sludge is as a rule disposed of during the summer months and where farm land is available sludge is disposed of by discharging directly on land and after the sludge dries it is ploughed in. This procedure is followed successfully at a number of small plants and has been entirely successful at the large plant at Canton, O. Sludge is usually taken from the tanks during the dry summer months of the year when land will absorb the water readily. This method is in quite common use in the south and on the West Coast where the water in the sludge has a distinct value to crops in addition to the fertilizer value of the sludge. With a well digested sludge, disposal is without nuisance and the fertilizing value of this material will surprise the most skeptical farmer. This method has not been given the credit it deserves and in locations where farm lands are adjacent to the plant it is an economical and practical solution for the sludge disposal problem. Common sense should prevail in distributing the sludge over the land. Excessive amounts in spots are certain to give pooling and thereby retard the drying period. The sludge is usually run into a main ditch from which lateral ditches serve the land.

Drying on Prepared Sand Beds.— The more recent Imhoff and separate



Some Examples of Poorly Drained and Unkept Sludge Beds

sludge digestion plants are provided with specially designed sand beds for dewatering the sludge. If there were sand beds constructed for septic tanks, it it usually hard to find them as they are buried in weeds. Sludge is run onto the sand beds from 6 in. to 15 in. deep and with good weather is in a spadable condition in one to two weeks. Experience has shown that it is more practicable to dose the beds more frequently than to attempt to dry too great a depth. About 9 in. is a good depth of sludge on the beds and greater depth over this may delay its drying. The drying time for sludge depends on weather conditions, depth of sludge applied to beds; and, lastly, but of most importance, is the character of the sludge. A poorly digested sludge may not dry for months, whereas, if well digested it should dry in 6 to 14 days. Sludge as discharged onto drying beds contains 90 to 95 per cent water and will dry to 60 per cent moisture and lower. When in a spadable condition, the sludge should be taken off the beds immediately so that it will not be rained upon and get mouldy. If properly digested, the sludge will not give off offensive odors during the drying process. The dried sludge has a slight odor of humus which is not objectionable. The dried sludge can be piled up near the beds until ready for final disposal.

This Shows a Well Drained Sludge Bed at Hartford, Wis., Also a Good Sludge as Indicated by Its Small Cracks

Dried Sludge Used as a Fill.—The two outstanding methods of disposing of the dried sludge are by using it to fill in waste land and its use as fertilizer. Many plants pile up the sludge near the plant to the detriment of the appearance of the plant grounds. If low ground is not available at the plant provisions should be made to haul the material elsewhere. More attention paid to the appearance of the plant by the operator will result in the town taking an interest in spending money on operation and improvements. Sludge piles around a plant are an eyesore and in this age of progress the value of the sludge as fertilizer is well known and appreciated by the wide-awake farmer who will take all the sludge that is produced without cost to the city.

Dried Sludge as a Fertilizer.—This statement might seem a little optimistic but if an operator cannot induce the farmer to take his sludge, he is considered a poor salesman. We have heard for the past twenty years or more that digested sludge has little fertilizer value. This is true relatively when based on the chemical analysis and compared with commercial fertilizers. Sludge contains valuable ingredients which are not shown by the chemical analysis and which have the effect of loosening the soil and stimulating bacterial growths. Experiments on laboratory scale and in actual practice have shown the great value of this material as fertilizer.

One thing which has made the farmers skeptical is the fact that the material is had for the asking. It is much easier to sell an article of this kind than to give it away. A story comes to mind which illustrates this point, and which is entitled **A Better Method.** "I don't know what to do with this mongrel," moaned Jones, "I've done my best to give him away." "Give him away," protested his up-and-doing wife. "That's no way to get rid of a dog. Ask $20 for him."

Large quantities of dried digested sludge are used for fertilizer in this country, much more than most of us realize. Large cities like Baltimore, Md., Rochester, N. Y., Madison, Wis., Marion, O., and others, have sold the sludge at a nominal price for fertilizer for many years. Hartford, Wis., with about 4,500 people and Kiel, Wis., with 1,600 people use all of their sludge on lawns and shrubbery in the parks in which these plants are located. Many plants have made arrangements with farmers to remove the sludge from the drying beds in payment for the sludge.

Col. E. D. Rich, Director of Bureau of Engineering, Michigan Department of Health, states that the following towns and others in his state are using the sludge as fertilizer: Romeo, pop. 2,500; Grosse Pointe, pop. 3,000; Lapeer, pop. 3,000; Fremont, pop. 2,000; Muskegon Heights, pop. 15,000; and the city of Pontiac with population of 50,000 disposes of its sludge at a price of fifty cents per load. Sludge has been accumulating around this plant for about 3 to 4 years. Offers to give it away failed. The perseverance of the operator and possibly the establishing of a price for the sludge were responsible for interest in this sludge as all of it is sold and none accumulated because of the demand for it.

Many other instances could be cited but the examples given should be convincing evidence to any farmer that this material has value as a fertilizer. From the viewpoint of the operator, his main object is to get it off the sewage plant site even if a revenue is not obtained. A small charge may have its psychological effect in creating a demand for the sludge.

It is hoped that this article will be helpful in pointing out a way to have the sludge removed from the plant sites so as to make it possible to keep the grounds appearing in a respectable condition.

Cincinnati Adopts Uniform Standard Design for Street Casting

All street castings used by the various city departments of Cincinnati hereafter will be purchased under the direction of the city manager. The purpose of this arrangement is to secure a single standard specification for all types of inlets, manhole covers, and gratings, of the best possible design, and of a sufficient strength to carry the heavy loads of modern traffic without breaking, and particularly to do away with the noisy rattling and rocking of manhole covers that has been such a nuisance in Cincinnati and all other cities in the past. These manhole covers will, in future, be machined to an absolute fit so there will no longer be any noisy rattling of these covers.

It is expected, through the co-operation of the Utilities' Companies, to secure in the near future a similar arrangement in regard to their castings used in the streets.

The "Come Back" of Toll Bridges.—On Jan. 1, 1928 there were 233 toll bridges in the United States, 191 of which were privately owned. Since that time construction has been started on 29 new ones, and 163 are proposed. Of the 233 existing the first of the year, 86 were built in the last ten years.

How New York City Use Statistics for Accident Prevention

How Investigation of Accidents Leads Way to Prevention

By PHILIP D. HOYT
Deputy Police Commissioner, New York City

THOSE of us who are responsible for traffic control in New York City know the importance of using facts in deciding upon our traffic program. Traffic counts, speed tests, and other factual data which we obtain, are used almost daily; but no set facts that we obtain are more important than the accident statistics which we use in our plans for traffic control.

The traffic problem is one of many phases. City or regional planning, the study and initiation of engineering projects which will provide additional facilities, is one of them. Regulation or handling of traffic with existing facilities is another. Discussion of the traffic problem too frequently considers one purpose of regulation—the acceleration of traffic, and ignores or minimizes the more important function, the protection of human life. Speeding up traffic is of course an essential object of regulation, but public safety comes first. The primary duty of the police in handling traffic is no different indeed from its duty to protect society against the criminal element. That is why traffic regulation generally lies in the hands of the police.

The complexities of the traffic problem in New York City are increased not merely in proportion to its population, but because of many other factors, some of them peculiar to this city. The geographical barriers which divide and surround the city; the density of population; the height of the buildings; the number of automobiles; the extent of the suburban district—all complicate the situation. Handling traffic safely under such conditions on the city's five thousand miles of streets, is a task calling for the utmost effort.

Accidents Reduced.—Our toll from street accidents is high; yet we feel we are making some progress in our attempt to serve human life by a thorough and systematic study of accidents. Last year, for the first time since the appearance of the automobile, the number of fatalities and injuries to both adults and children resulting from highway accidents in this city, decreased from the preceding year. The fatalities from motor vehicles in this city in 1927 were 17.8 per one hundred thousand of population. The figures of the National Safety Council show that the general rate for the entire country, urban and rural, was 19.6 per hundred thousand, while the urban rate was 22.4.

The most encouraging fact, however, is that since 1923 there has been a steady reduction year after year in fatalities to children of sixteen and under, due to highway accidents in New York City. In 1923 there were 453 children killed; in 1924, 432; in 1925, 422; in 1926, 413, and in 1927, 408. In the first eight months of this year 218 children were killed as compared with 266 during the corresponding period last year, a decrease of 18 per cent. It is not, however, my intention to burden you with figures. Those I have just referred to are sufficient to give you a picture of the accident situation in this city and to show the decided progress in the reduction of accidents. This is due in no small measure, in my opinion, to our use of accident records. It is my purpose in this discussion to tell you something about our system of collecting, classifying and using these records.

Accident Card.—The information relating to each accident involving death or injury comes in the first instance from a report made out by the patrolman on post. A printed card used for this report calls for certain specific information. The principal causes of accidents are specified on this card, so that the patrolman who has occasion to make out the report knows exactly what information we require. On the back of the card is a blank space calling for the details, for purposes of further classification. Our total force of 17,500 policemen is at our service in investigating accidents and making out these reports. One copy of the report or printed card goes to the local police station, in the district where the accident occurred. Another goes to the Information Bureau at Police Headquarters for various uses which will be referred to, and a third goes to the Accident Record Bureau of the Traffic Division, also at Police Headquarters. The Captain of each of the local precincts keeps his own file of these cards and prepares from them a precinct spot map of accidents in the district of which he is in charge. Each Captain is thus able to keep in close touch with the situation in his locality. The cards returned to the Information Bureau are used for a variety of purposes, such, for example, as checking up persons who have been reported missing, and who the cards may show have been removed to a hospital following a highway accident. The cards returned to the Traffic Division are first classified by names alphabetically. Reports are received daily from the Medical Examiner, and these are carefully checked; so that when an accident victim reported as injured later dies, the report may be corrected.

Causes Listed.—Every accident is next listed as to the cause. Seventy different causes are included in this classification. The cause records are the basis of a monthly report. The next classification is according to location. This is made in three ways. First, by a file of streets and avenues; second, by police precincts, and third on spot maps which show the location of all accidents involving death or injury for each of the five boroughs of the city. Further classifications are made as to the hours of accidents and the ages of the victims, divided into several groups. In the case of children sixteen years old or under, several special classifications are made. These are according to ages, hours, school districts and schools.

All these records being merely collected, classified and filed away would be of little value. To avail ourselves, therefore, of this store of information is our next task. It is one to which we have devoted considerable thought in an effort to develop a system that would be of material aid in reducing traffic hazard. The monthly summaries are carefully studied. Our first interest is in the total for the month and the comparative figures for the preceding month and preceding years. Are accidents increasing or decreasing? Are children or adults the victims? What are the principal causes? Are they on main avenues or side streets? What hour do they occur? The answers to these and similar questions are found in the summaries and they give us a general idea of the accident situation in the city.

Locations Studied.—Closer study is made of the localities of accidents. This street has a high record. Is it because of the lack of traffic control, or inadequate regulations? The locality classifications are of particular interest in our planning of traffic control light systems; in fact, they are the basis of our request for appropriations for that purpose. Traffic lights may be provided where policemen may not. By the end of this year some 3,500 intersections in this city will be controlled by traffic lights. It would take about seven thousand policemen to cover these crossings

during the hours when the lights will be in operation, involving an annual cost of more than seventeen million dollars. That does not mean we save that amount by supplementing traffic officers with traffic control lights, but it does mean that traffic lights will provide control at nearly three thousand intersections where otherwise control would be impossible, not only from the standpoint of cost, but because of the difficulty of obtaining and training that number of additional men of the right calibre.

So in planning our traffic light programs, the reports showing just how many persons were killed and injured on each thoroughfare of the city are of the utmost importance. The assignment of the three thousand men detailed to traffic duty in this city and the sixteen hundred others who do special duty in the vicinity of schools, is another task calling for frequent reference to the locality record.

Special Regulations.—In addition to the general regulations which the Police Department makes for the control of traffic here, several hundred special regulations affecting particular localities are made each year. In our consideration of the necessity for such regulations, many of which are requested by residents or civic organizations in the various neighborhoods, the locality accident records are of great use. These records also aid in the direction of the activities of the police in enforcement. They often tell us where more attention should be given to speeders, or that drivers are not observing strictly the regulations covering turns, right of way, or other rules.

Investigation Squad.—In order to go more deeply into accidents involving deaths in this city, the Traffic Division has recently inaugurated a system providing for a more detailed investigation of such accidents. Every death now occurring in the city as the result of a highway accident is investigated by a special squad, operating from Police Headquarters. This squad is composed of experienced traffic men who work in uniform. The work is so distributed that the investigator can give a full day to each fatal accident. Although the information received from the patrolman on post is quite complete, there are frequently conditions at the points where accidents occur which the ordinary policeman does not feel the responsibility to investigate and make the basis of recommendations to his superior. The members of this special squad, being few in number, know exactly what information is required, and their business is to make recommendations to improve traffic conditions at that point. The investigator visits the scene of the accident at the same hour of the day when it occurred. This enables him to take into account all conditions at that particular time, such, for example, as the volume of traffic, street lighting, or many other factors. The investigators are all draftsmen, and their report includes a diagram of the locality, showing all the physical conditions and the position of the vehicles or pedestrians figuring in the accident. Specific information covering several points is required in the report—whether there was a traffic post or a traffic light at the point involved; the street lighting condition; any special traffic regulation, such as one-way street; and the condition of the pavement. These reports are taken up in conference with the patrolman who wrote them, and there is a thorough discussion of conditions at each point, for each fatality, so that we may get an answer in each case to the question whether anything possible can be done to improve conditions.

Jurisdiction.—Many of these recommendations naturally come within the jurisdiction of the Police Department. Attention may be called to a crossing where traffic lights or traffic policemen should be provided, warning lights indicating dead end street, for example, or various other traffic regulations of a cautionary nature may be necessary; regulations such as one-way streets may be advisable. The investigator's visit may result in the discovery that particular attention to enforcement should be given at this point. White lines to designate pedestrians' crossings may be needed. Many recommendations relate to other departments. Street lighting conditions may be in need of repair or improvement. Repairs to highways or bridges may be necessary. The highway facilities may be inadequate, requiring engineering measures for relief. In some cases the recommendations relate to individuals or private agencies, involving, for example, the routing of vehicles to less congested sections. The investigations frequently disclose facts of interest to the school authorities and their cooperation is sought.

This system of a detailed investigation of fatalities, although comparatively new, and by no means fully developed, has been found to be of the greatest assistance to us in improving traffic conditions.

So you see there is hardly a step in our traffic program, whether it relates to the assignment of personal investigators, the placing of traffic equipment, or the use of our broad regulatory powers, that is not based upon our accident experience.

In addition to the uses which the Police Department makes of our records, these records are also constantly being supplied to private agencies for use in accident prevention. They are supplied in detail to safety organizations. Organizations interested in the extension of the playgrounds throughout the city obtain them regularly to support their requests for additional recreational facilities.

Safety Education.—One of the most important uses of these records is in connection with the safety education program which the Board of Education is carrying on in this city under the personal supervision of Dr. William J. O'Shea, Superintendent of Education, and also in the parochial schools in the five boroughs of Greater New York. Every month an analysis of accidents involving children of sixteen or under is sent to the school authorities. This analysis stresses the causes of accidents and shows how these accidents vary from month to month. By means of these analyses the school authorities are able to determine what careless practices lead to accidents, and to impress upon the children the need for personal carefulness in these respects. Each of the twenty-seven school district superintendents receives a report for his district. A separate report is prepared showing the number of accidents involving children attending each of the 994 schools in the city; so that each school principal may learn every month whether the accident toll for his school is decreasing or mounting. The value of educational methods in accident prevention cannot be too highly estimated. Our own experience shows that can be done, although thus far we have made only a beginning.

One of the most important uses that can be made of accident statistics, in my opinion, is in safety education. This can best be accomplished through the schools. Safety education in the schools has been greatly developed during the last few years, but its possibilities as a regular part of our school program are only beginning to be realized. Teaching the children how to take care of themselves under present-day traffic conditions is a duty no less important than teaching them reading, writing or arithmetic. Safety instructions, furthermore, can be combined with those and other subjects of the regular curriculum without taking any additional time. Such instructions, in fact, can be so planned that it will stimulate interest in the subjects into which it is incorporated. Education is not my forte, but I feel so strongly on this subject that I cannot refrain from making this reference to it. Personal safety, in my opinion, should be an acknowledged subject of instruction in the schools throughout the country. The importance of such a program is recognized. It remains only for some countrywide educational organization, perhaps some great educational foundation, to get behind this movement, in which great strides have already been made, and develop a systematic, comprehensive plan of safety education, which will be generally accepted as an essential part of the training of our youth. There is no accomplishment that I can think of that would be more worth while.

Acknowledgment. — From a paper read before the recent National Safety Congress, and reprinted with permission of the National Safety Council from the Transactions of the Congress.

Some Problems of Water Distribution in New York City

Providing and Maintaining Servicea ble Pressure in Distribution System

By FRED B. NELSON

Assistant Engineer, Dept. of Water Supply, Gas and Electricity, New York City

IN New York City the introduction of the Catskill supply, delivered by gravity at a much higher head than the original Croton and other supplies, made possible extensive improvements of pressure and changes and extensions of service zones and involved many radical changes in distribution. These were local conditions for New York City that have added materially to those problems, common to all cities, of providing adequate distribution to meet the present and prospective demands of sectional development, population increase, etc.

In New York City the Croton supply is delivered by gravity at a head of 133 ft. above sea level at Jerome Park reservoir near the north end of the city, and is carried southward through original aqueduct lines, terminating in Central Park reservoir at 118 ft. above sea level. The Catskill supply is delivered by gravity at 293 ft. above sea level at the north city line and from there is conveyed by 18 miles of deep rock tunnel through the west side of Bronx borough and throughout the elongated island of Manhattan to Brooklyn. This Catskill supply is available for these two boroughs from 18 riser shafts along the line of the tunnel, instead of having to be conveyed southward by trunk lines as with the old Croton system.

Four Service Zones.—To correspond with the topography of the boroughs of Manhattan and the Bronx, the system includes four service zones, supplied under heads suitable for service to the ground elevation included in each. These are: Low service supplied by Croton water under gravity head, intermediate service supplied by pumped Croton, together with Catskill under reduced and regulated head, high service supplied by Catskill gravity or full head of the Catskill tunnel and tower service of Manhattan supplied with Catskill and Croton pumped to about 50 ft. above the available Catskill head for adequately serving the area of highest elevation.

In general the aim has been to utilize the original Croton gravity as fully as possible, reserving Catskill for the higher areas and to save pumping. Unnecessary extension of Catskill service into areas where Croton gravity could be feasibly used by proper changes or reinforcement in the distribution system has been avoided.

This feature was a factor in a recent problem of improving supply to roughly 10 square miles of East Bronx low service area, where a tremendous post-war expansion and building development had rendered the original small supply and distribution mains seriously inadequate in maintaining serviceable pressures under the low Croton gravity head. The need was apparent for a comprehensive hydraulic, or gradient survey, to determine the necessary size and location of needed trunk mains or other changes required, and such a survey was made in the latter part of 1924.

How One Problem Was Handled.—With the center of distribution about 4½ miles from the source and limited by the head of 133 ft. at that source it was considered economically feasible to maintain the area below the 40 ft. contour on the Croton low or gravity service. This would allow a 24-ft. pressure loss in maintaining a minimum of 30 lb. at the 40 ft. or highest elevation.

In determining the location and size of main needed, other less tangible though important factors have to be estimated and used. These gradients were obtained in December, 1924. It was estimated that maximum summer-time consumption in that area, including large summer tent and bungalow colonies, would be 25 per cent greater than in December, giving pressure losses 50 per cent greater than those indicated. Also it was assumed that at the rate of development then under way the consumption of the area might double in five to ten years. Thus the maximum near future consumption might reach 200 per cent of that existing at the time and season of the survey.

The positive data on existing conditions, as presented on the map, clearly indicated by gradient slope, the location and length of needed trunk mains. The size of main was determined by assuming an increase of flow, corresponding with the estimated increase in consumption and selecting a size sufficient to carry such a flow with a loss of head reduced to an amount corresponding with good practice and safely within the limited allowable margin between the supply source and the distribution thus not only to improve the pressure but to maintain it against reasonably distant future demands.

The recommendation for new mains, based on this survey, included 8,000 ft. of 36-in., 11,000 ft. of 30-in. and 19,000 ft. of 20-in. It was estimated that the larger sizes recommended as supplies would include pressures by about 4 to 5 lb. The 20 in. was mainly intended to strengthen the grid for fire supply and to so inter-connect the two larger supply mains that either could serve alone in emergency.

Extending the Bronx Intermediate Service.—Since introduction of Catskill supply the Bronx intermediate service has been greatly extended. Two large north and south trunk mains of the original Croton system, one on the east and one on the west side, have been utilized. The present main source of supply for this service, as previously mentioned, is from Catskill shafts along the pressure tunnel lying west of the service and paralleling those original main arteries. The lack of trunk main capacity in an easterly direction from the tunnel to the original main and centers of distribution has been overcome by hand regulation at the shafts, increasing the day-time pressures and output at these points to that necessary to maintain serviceable pressures at the center of distribution and reducing at the source to avoid excessive night-time pressure increase on the distribution system. The problem here presented did not involve the design of a system of reinforcement to provide serviceable pressures with a very limited head at the source, but rather the determination of size and location of main necessary to so reduce the excessively varying pressure losses as to permit maintenance of fairly uniform pressures on the system with a comparatively constant head at the tunnel. Such a condition is also desirable to permit more automatic regulation to replace hand regulation and to obviate unavoidably serious pressure fluctuations at extremities of the system. In the solution of this problem a gradient survey was made using the same method as previously described. In this case, however, on account of the wide fluctuation due to high pressure losses, extra care had to be exercised to have the gradients obtained under practically simultaneous and normal conditions in order to be comparable in any combination on the final skeleton map. This required some repetition of work and averaging of results, but the variations on repeti-

tions of tests were generally negligible in comparison with the pressure losses determined.

Omitting details, the final map of results showed very flat gradients along those two original north and south trunk mains considered as "headers," but a serious day-time slope or pressure loss between the pressure tunnel and the westerly 48-in. header of 53 ft. determined along the 3,500 ft. of 36-in., constituting one of the main supplies. Also an additional loss of 25 ft. in the 9,000-ft. continuation of this main to the easterly header. The map presented other quite serious additional losses along secondary feeders so that, for example, at one point well within the service area the day-time head was 93 ft. or 40 lb. below that maintained on the supply main at the shaft. As before, the desirable location and necessary length of new mains was quite apparent on the map. The determination of size was made by selecting one whose capacity relative to existing mains, and when working with them, would be such as to bring these excessive pressure losses down to those corresponding with good practice and well-controlled pressures. The mains recommended included 4,000 ft. of 49-in. to eliminate the excessive pressure loss between the tunnel and the westerly 48-in. header and 11,000 ft. of 36-in. from this header to the easterly one to more nearly equalize them.

Such surveys establish the gradients available throughout the existing system, which together with the determined elevation of hydrants, or more roughly the street atlas elevations is used daily on investigations of pressure troubles and by the information desk in answering inquiries as to pressure at specific locations.

Gradient Survey in Manhattan.—In the borough of Manhattan a gradient survey of somewhat different character was made primarily for use in promptly solving these every-day and important problems. Briefly, it consists of a series of east and west gradient profiles of "hydraulic cross-sections" of Manhattain Island taken approximately ten blocks apart from the Battery to Spuyten Duyvil. It includes about 300 hydrants on all of which pressures were taken during the business hours of one day. The pressures were taken with accurate gauges that had been previously tested and calibrated and the corrections applied to the gauge readings in the computation. The nozzle elevations were determined by levels. These hydrant locations, elevations and gradients are listed by streets in geographical order and used daily by the parties on pressure investigations. For office use a street wall map is used, in which the four service zones are shown in color and the gradient of the service at different general locations indicated in large figures that can be read from the distance of the complaint and information desks.

These gradients were taken in September, 1923, under generally normal distribution and weather conditions and have been found very useful as standard reference gradients for solution of the varied problems involving depreciation of service due to increase of consumption and need of reinforcement, or the improvement secured by new installations or changes in distribution. They are useful in locating breaks in mains, open blow-offs, closed valves or restricted circulation and for intelligently advising a complainant as to whether his complaint is justified or due to local trouble under his own control, advising him what pressure to expect on the street main, and whether new or larger plumbing will improve conditions and supply to his top floor. They point promptly to open service boundaries, unwise changes in shaft distribution or regulation, etc. This gradient net work indicates very conspicuously the areas in need of better supply mains and it has been used together with special gradient tests as a basis in solving the problem of determining the size and routes of large trunk mains. Thus about 2,500 ft. of 30-in. steel and 4,500 ft. of 20-in. and 16-in. cast iron main have been laid east and west from one Catskill shaft to flatten the gradient and to relieve the over-load previously carried on the shaft next adjacent along the tunnel; 4,350 ft. of 36-in. steel main was laid to reduce a 16-ft. gradient slope across Central Park and improve pressures on high ground to the east. A contract is now under way for about 4,200 ft. of 48-in. and 3,800 ft. of 36-in. from 48-in. low service aqueduct mains eastward to improve upper east side low service pressure by reducing the present gradient slope of 32 ft. (or 14 lb. loss) in 5,000 ft. Contract is to be prepared for about 4,500 ft. of 30-in. main to reduce a present pressure loss between the Catskill tunnel source and the extremities of the system of 25 to 30 ft., and more fully utilize a Catskill shaft where output is now restricted.

Fire Supply Problems.—Fire supply presents an ever-present problem in all distribution systems. If the area in question is large and a possible fire draft a small percentage of the total consumption, the solution of the problem probably does not involve consideration of trunk mains, but rather tests to locate points where possible fire draft would exceed the limited capacity of the local grid-iron mains. If the consumption of area be small in comparison with a possible fire draft the solution may call for supply mains larger than necessary for the normal domestic and business consumption, in other words, the provision of suitable fire supply in such areas carried with it ample provision for daily consumption. In New York and other large cities, the areas involving the greatest hazards are protected by an independent fire supply system on which the pressure is raised at times of fire to suit the demand. Outside such protected areas of New York City, the solution of the problem of fire supply is based on tests made substantially as in other cities. A group of hydrants is selected for simultaneous discharge. Another hydrant on the side of the group opposite the apparent supply, or possibly within the group, is selected for observation of static and residual pressures. On signal from the man in charge, the observer at each discharge hydrant opens his hydrant fully and measures the discharge head by means of a pitot tube attached to a low reading pressure gauge, the gallons per minute discharged is obtained from curves of discharge at the various pressures and nozzle sizes. The observer at the pressure hydrant notes the static or normal pressure and the residual pressure with all hydrants open. The limit of capacity of the system at that location is estimated as the total discharge obtained from the group multiplied by the square root of the ratio of the static pressure to the drop in pressure observed with all hydrants open. If this limit of capacity falls below the requirements, of say third or fourth alarm, fires for that area, depending upon the hazard at that location, the final solution of the problem involves provision of mains whose size and location is usually obvious.

Occasionally the problem of safeguarding domestic and fire supply for an isolated high service area may be solved by insertion of check valves on the boundary between that and an adjacent low service of sufficient head to reach the high ground and under the head as reduced by the emergency demand. Such valves, if not in occasional action, should be watched and frequently tested.

Controlling Pressure.—In the problem of controlling the pressures in a system supplied by reduction of head at the source, automatic pressure regulation valves are frequently the logical solution. Such valves are used on the New York system, but usually not as extensively as originally intended. In general the non-use is not a discredit to the valve but has been due to the unusual condition imposed on its operation. The pilot valves of the automatic regular are actuated by variations of its down-stream pressure. In an overloaded supply main with a high friction loss between the source and the center of distribution the variations of demand in the system are not effectively transmitted as variations in pressures at the pilot valves, due to the law that the pressure loss varies as the square of the flow or demand and a serious increase in demand and consequently a much more serious pressure drop on the system is required to actuate the regulator at the source. Also a regulator midway on such a line cannot operate satisfactorily due to the added disadvantage of a highly varying

head on the up-stream side, the regulator tending to maintain a constant difference of pressure, transmits these variations to the down-stream side. Regulators working in parallel with nearby interconnection of their discharges have given unsatisfactory results due to the tendency for one of them to close as the other opens and vice versa. Where pressures have to be raised excessively at the source to maintain day-time pressures on the system the difficulty of utilizing regulating valves is obvious.

Underground Leakage.—The problem of control of underground leakage is a subject by itself and too broad to be included in this miscellaneous paper. It is, however, an important one, especially where subsurface conditions permit development of large and extensive leakage without surface indications. In New York City these conditions obtain in a very marked degree in the two boroughs of Manhattan and the Bronx. During years of plentiful supply and with a very small available force for the purpose we have been unable to do more than locate and repair leaks responsible for complaints of flows into basements, electrical conduits, steam lines, subways and other subsurface structures.

In the regular course, such complaints are received at the complaint desk of the main office and the order for investigation 'phoned to the repair shop of the district concerned. This order is followed by a copy of a written order, the original remaining at the office. Space is provided on the order blank for the foreman's report. When the leak is not found after a reasonable effort it is referred to the special waste detection force and is given study under engineering supervision. Practically every case thus referred is different and requires original and serious engineering study on the ground (and of conditions below ground) to solve the problem and locate the source, frequently a few blocks away, through a maze of subsurface conduits, gas and water mains, vaporizing steam lines, transit subways, etc.

It is anticipated that at or about 1935, New York City's consumption will have reached the capacity of its source of supply, and as this will probably precede availability of additional supply conservation measures are now being considered and adopted. Systematic surveys to locate and repair underground waste, much of which exists without causing complaint are being considered. One or two field parties are now being used on such surveys with the main object of determining how much underground leakage of this character can be stopped, what the cost will be per million gallons saved, what force and organization will be necessary to cover the fruitful fields in the reasonably few years available. Aside from the saving of water such surveys by small districts are a decided help in maintenance by incidentally locating and correcting various defects, closed valves, open service boundaries, restricted circulation, etc. On the second of these experimental districts now under investigation an unexpected pressure drop occurring on the closing of the boundaries to isolate the district led to the location of a 6-in. wide open blow-off on a 20-in. main discharging 6 m.g.d., measured, into the sewer. This blow-off had not been indicated on distribution maps since about 1908, but from other evidence it is assumed that the blow-off had not been opened that length of time. We do not expect such "finds" in all of the trial districts to be investigated, but this case found in the second district investigated serves as a suggestion of one possible source of tremendous unobserved waste in a system that include hundreds of such blow-offs, and but for the district waste survey this one would still be running.

Acknowledgment.—The above is an abstract of a paper presented at the last annual convention of the New England Water Works Association.

Centralizing Control of City Machinery

The city of Reading, Pa., has recently centralized the custody and maintenance of its equipment such as motor vehicles, pumps, fire engines, etc., in the hands of one official. The office of supervisor of public machinery has been established, his duties being outlined as follows in the ordinance: He "shall have the care, management, direction, control and administration of the maintenance and repair of all motor vehicles, fire apparatus, pumps, and other machinery of every kind and description belonging to or used by any of the departments, bureaus, boards and other agencies of the city. All such departments, bureaus, boards and agencies shall obtain all repairs and replacement parts for machinery through the supervisor of public machinery, and not by direct contract with private parties, nor by having said repairing done under their own supervision. It shall be unlawful for the city controller to countersign, or the city treasurer to pay, any warrants or checks for repairs to, or replacement parts for machinery, except upon certificate of the supervisor of public machinery, that such parts or repairs have been obtained by his authority and under his supervision."

The supervisor is given authority to organize and manage a municipal machine shop in which all repairs to public machinery are to be made. All necessary equipment and repairs are to be procured through the office of the city purchasing agent.

Short Course in Public Administration

The short course in public administration held last summer at the University of Southern California was a decided success, and it is probable that it will be repeated in 1929. The individual attendance in various sections was 749 and the total section attendance was 5,430. The public occupations and positions represented by those in attendance comprised Assessors and Tax Collectors, Board of Education and Superintendents of Schools, Budgets and Efficiency, Bureau of, Building Departments and Building Inspectors, Chambers of Commerce, Clubs, and Organizations, Citizens, Clergymen, Clerks, City and County, Commercial Firms, Controllers, Treasurers, Auditors, Accountants, Councilmen, Engineers in Public Work, Fire Departments, Health Departments, Legal Departments, Managers, City, Mayors, Miscellaneous, Planning Organizations, City and County, Playground and Recreational Departments, Police Departments, Probation Department, Purchasing Agents, Social Welfare Workers, Street Traffic Organizations, University Students, Water, Power and Light Departments.

Average Life of Street Department Horses at Toronto, Ont.—The average life of a horse in the service of the Department of Street Cleaning of the City of Toronto, Ont., is 6½ years, according to the 1927 report of George W. Dies, Street Commissioner. The care of the department's 384 horses is under the direction of a veterinary surgeon, whose services are engaged on a per capita basis of $4.00 per horse per annum. His duties are to render the necessary veterinary services to sick horses, advise as to the proper feeding of the animals, and the necessary sanitary precautions against disease. He also examines and certifies as to the soundness of all new purchases, and condemns animals unfit for further service. During 1927 48 horses were purchased at an average price of $230 each. A card record is maintained of each horse as to date and from whom purchased, price, color, markings, age, height and weight. The time lost by horse, due to illness or other causes, is also recorded, as well as the date of disposition, cause, and sale price.

Washington, D. C., Has Spent Over $25,000,000 on Sewerage.—The total length of the sewer system of Washington, D. C., on June 30, 1927, was 868.97 miles of which 166.21 miles were main sewers and 702.70 miles were pipe sewers. The total cost of this system was $19,181,762. The length of the sewage disposal system was 39.52 miles and the cost was $6,237,292.

The City and Abandoned Street Car Tracks

How Some Cities Are Taking Care of the 9 Ft. Strip on Streets

SINCE the bus has superseded the street car in many localities, municipalities are faced with the problem of taking care of the 9 ft. strip which always was considered the direct possession of the utility using it. Cities are faced with a problem which was not anticipated even as late as the past five years. In many cases this area presents a very serious problem as it burdens the taxpayer to an extent which is not provided for in any way. How this problem is being handled in some cities was outlined by L. P. Booz, City Engineer of South Amboy, N. J., in a paper presented at the recent 9th Annual Conference of the International Association of Street Sanitation Officials, from which we have taken the matter that follows:

In some states the operating companies had to maintain the area occupied by their company and had to pave same whenever the street through which they operated was paved. They also had to keep this area cleaned and had to remove the snow therefrom in order to keep their franchise.

With the discontinuance of service and the abandonment of the tracks, the street area which is to be paved and maintained becomes 30 per cent wider and a 30 per cent greater burden to the taxpayer. An additional 9-ft. width had to be maintained, paved and kept clean, at an additional cost to the municipality.

In the State of New Jersey the car lines are automatically relieved of the burden of paving the before mentioned area. Utility companies which have been discontinued and failed because of a lack of travel on their lines, have abandoned the tracks and road bed as they existed. The final disposition of the tracks and road bed material in some localities where the service has been discontinued is still problematical. There is even talk of leaving the road bed as it exists and later continuing the service with its privileges should the necessity return.

The problem as it presents itself consists of restoring the street or roadway so that the public may acquire the full use of same as economically as possible.

The first condition encountered is where the tracks and road bed are abandoned on streets which are now paved to the full width between curbs, including that area paved by the street car company. The removal of tracks together with the ties, guard rails, and road ballast, would be a very expensive proposition, and in many cases the cost would be prohibitive. However, there are places where it is absolutely necessary to do all this work. Where the road bed has not been properly maintained, the ties will be found to be corroded and decomposed and in such condition that the road would continue to cave in because of the insecure foundation.

In some cases it is possible to remove tracks only and replace same with concrete or other foundation, and to surface the area formerly occupied by the track to a level with the surrounding roadway.

A still more economic procedure is to cover the rails with a thin layer of bituminous material which is sloped off on either side, so as not to make too great an obstruction, and allow for safer crossing than the track affords. In wet weather the tracks are often the cause of skidding of automobiles, and many accidents result therefrom. In some cases bituminous filler is used to bring the area occupied by the flange of car wheel to a level with the top of rail. This method can only be used where the grooved rail is laid.

The second condition met in the abandoning of street car tracks is the street in which the area between the tracks has not been paved. In a great many cases the operating companies have merely made a gesture toward maintaining their part of roadway, and with the abandonment of their lines there is a remaining 9 ft. which must be paved by the city, borough or municipal authority having jurisdiction therein. The method of paying for pavement improvements in most municipalities is for the city to pay a share and the abutting property owners on either side to pay the remaining share. This work is financed, bonds being issued for a definite term, and the city's finances regulated to meet the terms of the bond issue. This expense of a 9-ft. width of pavement is added to the property owner's or the city's share of the taxes, immediately causing a direct increase in taxes without any revenue being derived therefrom.

There are many townships in the State of New Jersey and in other states left either with a dangerous area 9 ft. in width as an additional expense, or as a menace to the traveling public. Unless the state and counties take a large share of this burden from the municipalities the conditions seem very unfair.

There are various opinions expressed as to the length of haul which is necessary in order for the street car to compete with the rapidly increasing busses. There are some traffic men who claim that there is a possibility of the street car coming back to take care of certain traffic conditions. The only way to solve this problem to the benefit of the taxpayers and the public at large would be to have the state make a thorough and comprehensive traffic study and make proper determinations as well as assist with the cost of resulting paving.

There is one great benefit to be derived by municipalities in which street car service is abandoned. The constant congestion and interruption of traffic caused by the use of street cars will be altogether eliminated and the public will have the use of the full width of the street. In a great many cities there is only sufficient width between the operating street car and the parked car for one line of traffic. Where the careless motorist does not properly park his car traffic is entirely stopped in that block until the street car passes the next street intersection. In this case the benefit is great and becomes the only cure of a traffic evil which was not anticipated, most of the street car companies having obtained their franchise when the only other street traffic consisted of horse-drawn vehicles. There are some cities in the State of New Jersey in which the street car traffic completely paralyzes other vehicular traffic in the main arteries of travel.

In conclusion I would say that there are many conditions of a local nature with which I am not familiar and which I have not discussed. But I believe for several years hence this problem will be a large and important one until the street cars are abandoned or until they are linked with the busses in an efficient and economical system of transportation.

Swimming Pool Classification in Colorado

The Colorado State Board of Health has divided public bathing places into three general classes according to minimum specifications for sanitation features. Class A bathing places are those in which there is no danger of infection, and their specifications require, among other things, scum gutters, the recirculation, filtration and sterilization of the water, and the maintenance of from 0.2 p.p.m. to 0.5 p.p.m. of residual chlorine in the water at all times that the pool is in use. Class B bathing places are those in which the danger of infection is slight, their specifications including the addition of clean water or the periodic sterilization of the water in the pool as suggested in a previous paragraph. Class C bathing places are those which are unsafe. Due to extremely limited funds and personnel, the classification of the pools in the state has progressed very slowly, but it is hoped that this work can be materially expedited during the coming biennium, so that the people may know the relative sanitary safety of bathing places they patronize and that the unsafe bathing places may be closed.

Routine Records of Collection Service for Refuse Material

Good Operating Records of Collection Service Important

By SAMUEL A. GREELEY

Pearse, Greeley & Hansen, Hydraulic and Sanitary Engineers, Chicago, Ill.

THE collection of refuse materials is generally recognized as an important part of the refuse disposal problem, and the maintenance of good operating records is obviously essential to the best and most economical service. Nevertheless, there is such a lack of uniformity in records of collection work and service that an examination of the subject is pertinent.

There are two aspects of the collection work which emphasize the need and importance of good operating records. In the first place, the collection of refuse commonly costs more than its disposal. Oftentimes the cost of collection is several times the cost of disposal. If records are kept establishing standards of work and cost, the tendency will be to see and seek chances to reduce the cost.

In the second place, the collection of refuse touches the individual householder more intimately than almost any other branch of municipal service. A high and uniform standard of service to householders should be maintained. Good records of the routine service rendered help materially to improve and remove areas or points falling below the established quality of the service.

Phases of Refuse Disposal Problem.—A pictures of the refuse disposal problem as a whole should be kept in mind, so that the function of the collection service can be properly considered. There are four parts or phases of the refuse disposal problem as follows:

(a) House Treatment.
(b) Collection.
(c) Transportation or Haul.
(d) Final Disposal.

The collection and the transportation or haul have to do with the work of collection units and are closely related. Where the haul from the last point of collection to the place of final disposal is short, the load haul is not so important as in larger communities where secondary or supplementary methods of transportation are required. Thus the collection must cooperate with the house treatment and must deliver the refuse to the disposal place in the most economical fashion.

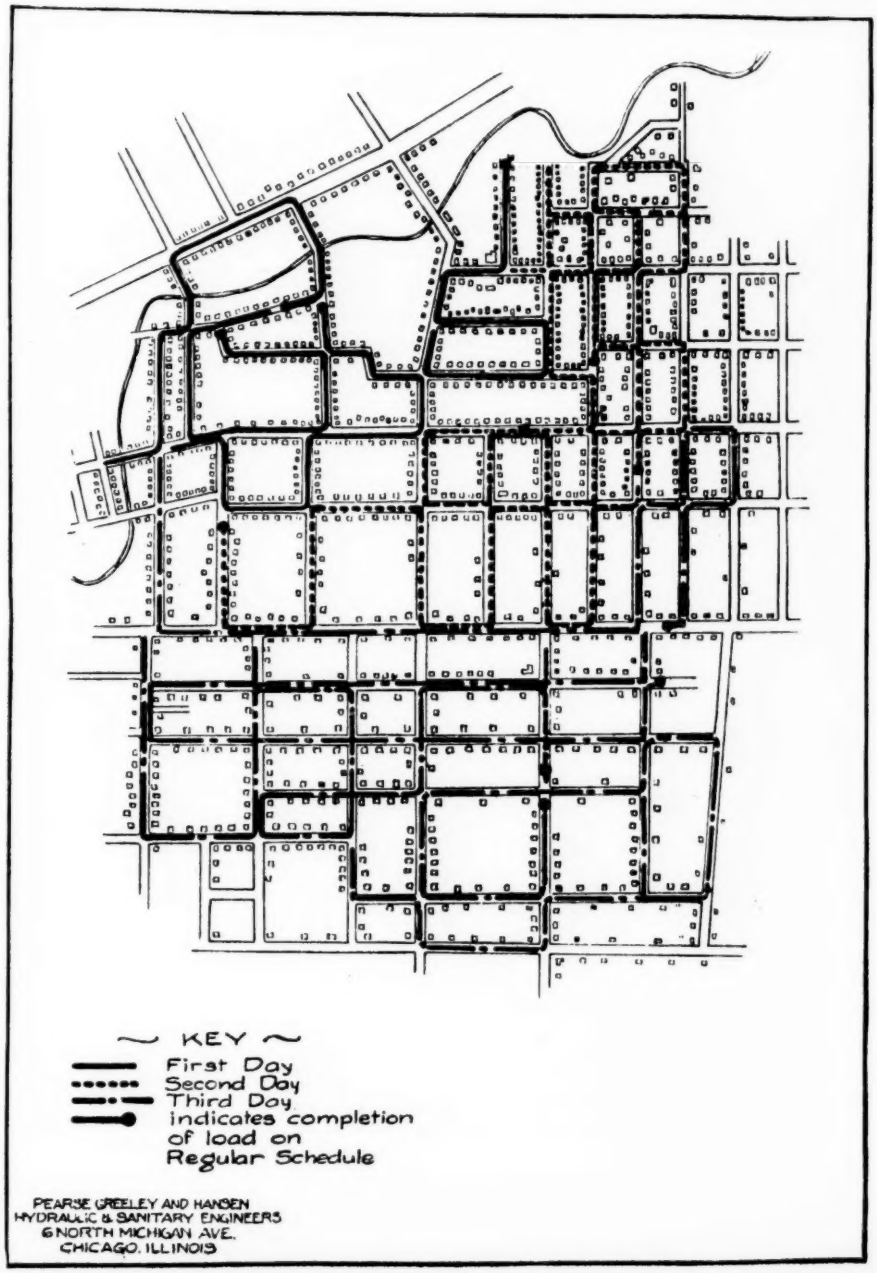
Functions of Collection Service.—The functions of the collection service are:

(a) To visit on a regular schedule every place where refuse is produced and where it has been decided to collect it.

(b) To pick up and haul away the refuse for disposal.

Thus one record or yardstick of the work is the number of houses to which service is rendered; and another is the measure of work done in volume miles or weight miles. Both yardsticks or measures indicate elements or service and cost and can be used to rate the functions of the collection service.

Collection Units.—The term "collection unit" is used to mean the vehicle and its attendants (driver, collector or helper) which actually make the collections. A collection unit may be a small horse-drawn wagon with one man, a horse-drawn trailer with two or three men, a large truck with a chauffeur and



Map Showing Route Record for Collection Unit for Collection of Garbage and Refuse

several collectors or helpers, or any similar vehicle. Different collection units are suited to different kinds of collection work and should, of course, be related thereto. Thus different sizes and types of vehicles are often used for collecting garbage, rubbish or ashes. The proper choice of the collection vehicle has a major bearing on the cost and efficiency of the service and operating records should be such as to guide the superintendent in the selection of suitable vehicles and in the most advantageous arrangement of the collection units.

Operations of Collection Unit.—The most important operations or work items in the routine of a collection unit include the following:

(a) Driving from barn or garage to first place of collection at the beginning of the route.

(b) Entering premises, picking up the accumulated refuse and placing it in the collection vehicle.

(c) Taking the loaded vehicle to the place of disposal.

(d) Unloading (and washing) the collection vehicle.

(e) Returning to a collection route for another load, or to the barn or garage for the night.

There are many minor operations along the way, such as hunting for hidden garbage cans, picking up spilled garbage, breaking out frozen garbage in winter, covering and uncovering the vehicles, reporting or handling complaints and the like. Such items affect the rate of speed of collection and are reflected in the number of houses to which service is given. Some of these operations are worthy of record such as reports on cans and house treatment problems and the handling of complaints.

TRUCK PROGRESS SHEET

DATE ..... TO .....

	Trip Number	LAST PICK UP MADE FROM MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
UNIT NO. 1 DISTRICT NO 3 DRIVER R Jones COLLECTOR J Smith	1	17 E Madison St	1620 West St				
	2	321 Flora Ave					
	3	8 Main St					
	4	960 Hooker St					
	5						
PICK UPS PER DAY		340					
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							
UNIT NO. ..... DISTRICT NO. ..... DRIVER ..... COLLECTOR	1						
	2						
	3						
	4						
	5						
PICK UPS PER DAY							

Sheet Used for Recording Truck Progress

The Service Factor.—By service factor is meant the ratio between the total number of houses or points of collection in a district or along a route, to the number from which collections are actually made. In nearly all collection districts there are some houses not requiring collection, including those temporarily unoccupied and those where the refuse is burned or disposed of on the premises. The writer has traveled along collection routes where the service factor is as high as 95 and along others where it was found to be as low as 65 and occasionally less. The service factor is difficult to record on a daily or routine basis but it should be known, at least approximately, but the superintendent who wishes to give intelligent scrutiny to the collection records. The service factor as well as the character of the collection district as to density of population, extent of pavements and the like affects the rating of the collection work in so far as in different districts different rates of work apply. These items should be considered when using collection records.

Elements to Record.—The major elements or routine operating records of collection service include the following:

(a) Bulk Handled. This is a record of the weight and volume of refuse handled by a collection unit. It is sometimes recorded in tons or cubic yards, and sometimes in loads.

(b) Distance Traveled. This is an important index of work and cost. It is frequently recorded as the number of trips of each collection unit. The actual miles traveled is a better unit.

(c) Collections Made. The number of houses (or possible points of collection) as well as the actual houses served should be recorded as it relates the collection unit to a measure of output or work done or service rendered. The record of complaints may be included here.

There are, of course, other less important items to record, most of which can be included under one of the foregoing three elements. Among these are the quantity of gasoline and oil, the amount of feed for horses, vehicle repair items, new tires, time of unloading, character of refuse, weather conditions, etc.

It is quite the usual practice to record the bulk of refuse handled in tons or cubic yards. Less frequently the distance traveled is recorded. With speedometers so adaptable there should be little difficulty in recording the mileage of each collection unit. There are very few cities where the "collections made" are of record. One of these is at Birmingham, England, where James Jackson, Cleansing Superintendent, has an excellent route system for recording the work of the collection units in terms of houses visited or collections made. In some places costs are computed on a per capita basis, but this does not measure actual work in rendering service.

The writer, however, believes that a

record of the service as measured by the collections made is of great importance and of inestimable value in comparing the work and service of similar communities and of collectors in a given community. This element, taken with those of bulk and distance, completes the measure of a collection service. Thus the number of pick-ups or collections made per hour is a useful measure of the work of a collection unit. In normal summer weather, with cans at the rear door, no alleys, good pavements and a normally well built up district largely of single houses on 50 to 100-foot lots, a good collection unit should work along its routes at the rate of about 40 to 50 garbage collections per man per hour.

Cost Records.—Cost records should, of course, be kept as well as service records. The total monthly cost should be divided into a few major items such as labor, gasoline and oil, repairs and the like. These should then be tabulated and charted in the several units given above as the cost per ton, per ton mile and per collection made. If such tables and charts include the total expenditures and the number of units (tons, miles, etc.), as well as the unit cost, they will serve as summary tables for the use and guidance of the executive department.

Route Maps.—Single large scale maps of each collection district showing house numbers are useful. The routes to be traveled by each collection unit should be marked as illustrated on the map (see cut at end of paper). The collector should follow these routes and upon reaching the place of final disposal after each trip, he should report the last house from which a collection has been made together with a note of any difficulties or houses not served. The record clerk would then assume that all other houses up to this point had been served. If a complaint is later received, it is either unfounded or the collector is at fault. The position of the collection unit along its route is also indicated and if he is falling behind he can be given assistance and later his routes shortened or changed. The attached Truck Progress Sheet shows how the record of "collections made" can be kept in this way.

Summary Records.—There are many record sheets in use for the bulk collected and none is shown here. However, a column should be included somewhere to show the miles traveled. As columns in a monthly sheet, the following headings are suggested:

(a) Collection Unit (Number).
(b) Trips or Loads.
(c) Tons.
(d) Miles.
(e) Ton-Miles.
(f) Collections Made.
(g) Pounds per Collection Made.
(h) Collections Made per Load.

Such records should be totaled each month and the totals divided with the total cost to give unit costs of work and service.

COMPLAINT NO
CALL

LOCATION _____
DATE _____ DIST. NO. _____
COMPLAINT _____
REPORT
TIME COLLECTION MADE _____
QUANTITY COLLECTED _____
COMMENTS _____
SIGNED

COMPLAINT NO _____
Special Investigation

LOCATION _____
DATE _____ DIST NO. _____
COMPLAINT _____
REPORT
DATE _____
YOUR REPORT MUST COVER THE ABOVE COMPLAINT
NAME OF PARTY INTERVIEWED _____
INVESTIGATOR _____

Complaints.—The number of complaints received is a fair index of the efficiency of the service. Complaints should be recorded and given prompt attention. A form for recording complaints is shown on the following page. Such a complaint slip can be made up in blocks so that triplicate copies can be made by using carbon paper. Preferably each copy should be on differently colored paper. One copy is filed by the receiving or complaint clerk, one is put on a hook where it is picked up by an emergency or complaint collection unit, and one copy is given to the collection unit on whose route the complaint originated. The emergency unit should pick up it slips at noon and in the late afternoon or early morning, so that morning complaints are handled the same day and afternoon complaints before noon of the following day. The emergency collection unit chauffeur should make his report on his copy of the complaint slip and the chauffeur of the regular collection unit on his, and these two should be filed with the original. Where complaints are of such a character as to justify a special investigation, the results should be recorded on a special form as shown.

Annual and Monthly Reports.—The use of monthly and annual reports is twofold—(a) to inform the executives and heads of departments of the local government how the collection service is going and (b) to inform the local public and those interested from other cities. If routine operating records are kept, there should be no difficulty about the preparation of the reports. Thus the basis of good service is the routine record of operation.

Acknowledgment.—The foregoing paper was presented by Mr. Greeley at the 9th Annual Conference of the International Association of Street Sanitation Officials.

Missouri Conference on Water Purification

The fourth and most successful Missouri Conference on Water Purification concluded its meetings at Hannibal, Mo., Nov. 17. Interest in the program was evidenced by unusually good attendance of the 75 members and guests present, as well as lively discussions following the presentation of all papers.

Several changes were made in the constitution of the conference. The name was changed to Missouri Water and Sewerage Conference in order to indicate the present scope of interest including municipal sewerage as well as water systems. Provision was also made to accomplish affiliation of the Conference with the Federation of Sewage Works Associations.

The time and place of next year's meeting will be determined by the incoming Executive Committee. Following are the officers elected for the ensuing year:

Chairman, C. E. Heflin, Water Commissioner, Cameron, Mo.; Vice-Chairman, S. J. Duncan, Superintendent Waterworks, Moberly, Mo.; Secretary-Treasurer, H. D. Peters, Assistant Engineer, State Board of Health of Missouri; Executive Committee, W. V. Wier, Assistant Manager, St. Louis County Water Company, University City, Mo.; E. E. Wolfe, City Chemist, Hannibal, Mo.; W. P. Britain, Superintendent Waterworks, West Plains, Mo.; J. N. Wells, Superintendent, Joplin Water Works Co., Joplin, Mo.

Berlin Plans $96,000,000 Merger of City Railways.—The City Council of Berlin has decided to merge the city's vast transportation systems, comprising subway, elevated, motor bus and surface cars, into one undertaking with a capitalization of 400,000,000 marks (about $96,000,000). The new system will be known as the Berlin Transportation Co.

Cross-Connections Between Potable and Non-Potable Water Supplies

Final Report of the Committee of New England Water Works Association

SOME time ago the New England Water Works Association appointed a committee to make a study of cross-connections and to submit a report thereon. The committee consitsed of Robert Spurr Weston, chairman, John S. Caldwell, E. Sherman Chase, secretary; Stephen DeM. Gage, Chas. D. Howard, Arthur C. King, H. O. Lacount, Warren J. Scott, Stephen H. Taylor, and Arthur D. Weston. At a meeting of the association on Dec. 12 the committee presented its final report. The report, with the exception of the preface and the appendix, follows:

Definitions.—By a cross-connection is meant a connection between the distribution system of a public or private, potable water supply and a private or secondary, non-potable water supply.

One common example of a cross-connection is that between the public water supply of a municipality and the auxiliary fire-hydrant or sprinkler supply of a mill or factory,—the former sufficing for ordinary uses and the latter for fire fighting only. Another frequent case is where under ordinary conditions the public supply is taken for drinking purposes and for use in toilets and lavatories only,—water for all other purposes being taken from the secondary industrial supply. In a third common instance, water for various industrial processes, including boiler-feed water, as well as drinking water and water for toilets and lavatories, is taken from the municipal source, leaving the industrial source for private fire supply and miscellaneous industrial uses.

Connections are usually made through piping and gate-valves, with or without accompanying check-valves. Check-valves vary in type from simple, single, iron check-valves, with a swinging clapper, operating against an unfinished iron seat, to elaborate double, bronze, check-valves, like those devised and specified by the Associated Factory Mutual Fire Insurance Companies. The former are not precisely machined to prevent leakage, are usually rendered inaccessible by being buried in the ground, and are liable to rust so that the free movement of their clappers is obstructed. The latter are of excellent workmanship, are usually set in pits, or where they are accessible for inspection at all times, and are built of non-corroding bronze with rubber-on-bronze seats. This type of valve is equipped with gages and test cocks. (See accompanying figure on page 26.)

The Demand for Cross-Connections.—The principal demand for the establishment of cross-connections comes from fire insurance companies and from property owners who desire two rather than one source of water supply in order that there may be additional protection to life and property. Opposition to cross-connections has come principally from the health and water-works authorities, largely because numerous epidemics of disease have been traced to these connections.

Industrial Use.—Many large industrial plants and public utilities require a constant supply of water for boiler feed, for cooling purposes and for various manufacturing processes. To insure continuous operations, some secondary standby supply, instantly available in emergency, must be provided.

It is usually prohibitive in cost to purchase public water for ordinary uses and at the same time to store a supply of potable water sufficiently large for probable emergencies. Some way of using both the public supply and a secondary supply when needed is a practical necessity.

Fire Protection.—The automatic sprinkler has made it possible to concentrate with safety enormous values in industrial plants, mercantile buildings and warehouses. The manufacturers of the country have utilized this advantage to such an extent that adequate fire protection is now a necessity for the profitable continuance of their business. It is doubtful if the industrial development of this country could have been so extensive without the safeguarding influence of automatic sprinklers.

A good public water system is the very best primary supply for automatic sprinklers, and there is usually no practicable way of providing an alternative primary supply that is the equivalent of a good public water system. Even large elevated tanks storing water from the public supply and erected at great expense are necessarily of limited pressure and capacity. But municipal water supplies alone cannot be depended upon in all cases, for two reasons:

1. Fire will not wait in case the public water supply should happen to be out of service. If the tremendous advantages of automatic sprinklers in extinguishing fires at the start are to be realized, there must be pressure always on the sprinklers.

The Associated Factory Mutual Fire Insurance Companies have recorded about three hundred instances in which public water supplies have failed or been interrupted. In twelve of these instances fire broke out simultaneously with the interruption of the water supply.

2. Public water supplies are frequently inadequate in volume and pressure for the large number of automatic sprinklers and hose streams that might be needed to cope with a serious fire.

Therefore, whenever the value protected, or the fire or life hazard involved, is sufficiently great, a secondary supply is needed in order that automatic sprinklers shall control a fire at the start. The labor laws of New York State permit double the number of employees in buildings equipped with sprinkler systems.

It is often impracticable to provide a secondary supply of potable water of sufficient capacity to assure a volume of water adequate for an emergency, such as an unusually severe fire or a conflagration. Secondary supplies, of non-potable water, however, can be obtained in sufficient volume by utilizing open bodies of water, such as ponds and rivers. A cross-connection is at present the only practicable method of combining existing potable public water systems and available non-potable secondary supplies of large capacity, both automatically feeding into a common fire protective system capable of meeting the demands of sprinklers and hydrants during the progress of a fire. Such cross-connections, in order to function instantly when fire occurs, cannot be dependent upon manual operation but must be automatic.

Cross-Connections and the Public Health.—The following is a brief abstract of twenty-five instances on record where outbreaks of disease have been brought about by pollution of drinking-water supplies through cross-connections.

In nineteen of these instances the cross-connection contained a single gate—or check-valve. It must be borne in mind that a gate-valve is not an automatic device and that is affords no protection unless closed. In three instances, protection against mixing of unsafe with safe water was afforded by two gate-valves or by a check-valve and a gate in series, and in one instance there were two gate-valves and a check-valve in series on the cross-connection. In one instance, it might be assumed from the wording of the published record that protection against pollution was afforded by two gate-valves and a double check-valve arranged in series, although this was not definitely stated. In another case this condition was defi-

nitely stated. It is also true that one of the double check-valves that failed was of inferior type and that one had not been inspected recently.

In addition to the list of recorded cases of sickness or death due to pollution entering drinking-water systems through cross-connections with unsafe water supplies, the Conference of State Sanitary Engineers and several sanitary authorities have listed a considerable number of cases where trouble was caused by the introduction of polluted water through leaks in emergency intakes or by similar causes. The report of your committee, however, is limited to the effect of cross-connections, important as the other sources of danger may be.

Position of the Public Health Authorities.—While from the broad economic standpoint it may be undesirable to run the risk of fire losses and, possibly, some losses of life by accident to firemen and industrial employees in order to avoid the hazard of sickness and death due to the existence of cross-connections, the saving of life rather than of money must always be the dominant motive for sanitary authorities. The following may be given as examples of the reactions of sanitary authorities to this danger.

The position of New Hampshire is as follows:

"As a historical preface, it can be stated that this matter has been receiving consideration by the New Hampshire Board of Health for more than a dozen years. Attempts at reform had their inception when, as a result of some bad conditions discovered, a legislative bill was introduced which sought to prohibit the existence of any connection on a public water supply through which polluted water might be introduced therein.

"The opposition at the time of the industrial interests was so intensely manifested and the impossibility of establishing a flat prohibition was so obvious that this department next proceeded to consider the special safety devices that were then available. Manufacturers were advised that the situation involving single cast-iron check-valves, usually buried in the ground and commonly not even known to the water-works management, could not be permitted.

"A few of these manufacturers then proceeded to install special type double checks but most of them continued to 'stand pat,' or, while promising, to follow a procrastinating course. This they were able to do (1) because of the absence of any legislation and (2) because of the lack by this department of any adequate inspectional facilities.

"In 1919 a law was enacted prohibiting the maintenance of a connection of this character, except such as might be approved by the state board of health. There was included a proviso that 'every valve, gate or other device for controlling or preventing the inflow of water of unapproved character into the public supply shall be of such construction as to permit of efficient inspection and testing, and at actual test thereof shall be made not less than twice annually by the individual, corporation or association furnishing water to the public.'

"A beginning was then made toward the eradication of the single iron checks and manufacturers, in response to their inquiries, were advised that the least that could be accepted was the device as now commonly in use, suitably installed in a test pit. At the present time 67 New Hampshire mills have these double-check connections.

"Although recognizing that the ideal situation is one involving no connection whatsoever between a public water supply and a polluted industrial source, yet, with us it is a case of doing the best thing possible in view of existent facts. While admitting that no such device affords an infallible means of protection, yet it also cannot be denied that no form of protective action against a polluted water supply can be said to be infallible, these depending, as all of them largely must, upon the human factor.

"Accordingly, it is the present policy of the New Hampshire Board of Health to permit, for the purpose of fire protection only, of the use, in lieu of mechanical severance, of a suitable connecting device of the best approved type, providing also that such be installed in a proper test pit, and maintained under periodic inspection."

In December, 1926, the Rhode Island State Board of Health, while without authority to prevent the installation and use of cross-connections, adopted a resolution advising that all such be abolished.

In its bulletin of January, 1927, the Connecticut State Department of Health published an article by the Director of its Bureau of Sanitary Engineering. In this article, the author cites the regulations of the department, namely, that after Dec. 31, 1926, no cross-connections shall exist between potable and non-potable supplies, except that installations protected by double check-valves of approved type with adequate facilities for testing that were in existence on Dec. 31, 1926, may be temporarily continued with the approval of the State Department of Health. The latter provision was inserted because it was felt that double check-valves of the latest approved type should be given a fair trial. The length of extension of time granted will depend upon investigations that the department is now making as to the efficiency of the newest types of valves. No new installations of double check-valves are allowed.

In New York State the Public Health Council of the State Department of Health adopted on Nov. 12, 1925, an amendment to its sanitary code which prohibited cross-connections between non-potable and potable water supplies after July 1, 1926. This regulation permitted the continuance of cross-connections where two gate-valves with indicator posts and two check-valves of the special design of the Factory Mutual Fire Insurance Companies or equal were installed, but such connections were to be discontinued after July 31, 1928. The regulation also permitted the use of dual water-supply systems where the auxiliary supply was delivered to an elevated tank, provided the connections were made through an open discharge pipe above the high-water line of such tank.

On June 27, 1928, the Public Health Council voted to grant a further extension of six months. On July 3, 1928, the Commissioner of Health sent a letter to water-works authorities throughout New York State saying that, as a result of the development of a special fire-pump chlorinator, it was the opinion of the department that the installation and proper maintenance of such a chlorinator would satisfactorily meet the requirements of the sanitary code. The letter further outlined certain conditions that were to be met prior to the approval by the department of such cross-connections. Among these conditions was one calling for the proper installation of all-bronze, double check-valves between the fire-supply system and the municipal system. A copy of the letter is given in Appendix G.

In New Jersey a new chapter (Chap. XIII) to the Sanitary Code, enacted by the State Department of Health on Sept. 18, 1928, reads as follows:

"Regulation 1: A physical connection shall be considered as any cross-connection, by-pass, valve, pipe line, auxiliary intake, or other similar device which permits or may permit any flow of water into an approved public potable water supply from any other water supply unapproved by the Department of Health of the State of New Jersey, or any source of water supply not fully treated in accordance with the terms of the provisions of the permit issued for or the rules and regulations governing the supplying of such water for public potable purposes by the Department of Health of the State of New Jersey.

"Regulation 2: That after April 1, 1929, physical connections shall not be permitted, except where such physical connections existing on April 1, 1929, include two all-bronze check-valves with rounded rubber facing, two gate-valves with indicator posts, or rising stems and drip cocks and gauges for testing, and such physical connection is located in a vault or pit of water-tight construction readily accessible for inspection: and,

"Provided, That the application for the continuation of such a physical connection is made to the local board of health having jurisdiction and is approved by such local board of health, the date of continuance may be tem-

porarily extended by the Department of Health of the State of New Jersey."

General Code of the State of Ohio, Section 1252-3:

"It shall be unlawful for any official, officer, or employee having in charge or being employed in the maintenance and operation of a public water supply and water-works system or for any other person, firm or corporation to establish or permit to be established any connection whereby a private, auxiliary or emergency water supply other than the regular public water supply may enter the supply or distributing system, unless such private, auxiliary or emergency water supply, and the method of connection and use of such supply shall have been approved by the State Department of Health."

Other states have made similar regulations but the above will suffice for illustration.

Action of the American Water Works Association.—The fire-protection division of the American Water Works Association adopted the following resolutions at Louisville, Kentucky, May, 1925:

"WHEREAS cross-connections between potable public water supplies and supplies from other sources have been the cause of a large number of outbreaks of typhoid fever and other water-borne diseases, and

"WHEREAS, check-valves and other similar protective devices cannot always be depended upon, be it

"RESOLVED, that no physical connection should be permitted between a potable public water supply and any other supply except as follows:

1. With another potable public supply.

2. With a potable supply which is regularly examined as to its quality by those in charge of the potable public supply to which the connection is made.

"This prohibition to apply to all piping systems either inside or outside of any building or buildings, and

"BE IT FURTHER RESOLVED, that definite programs should be inaugurated in each municipality to permanently eliminate all other connections.

Action of the Conference of the State Sanitary Engineers. — The following resolutions were adopted in 1926 by the Conference of State Sanitary Engineers:

"WHEREAS, cross-connections, auxiliary intakes and by-passes between potable public water supplies and supplies from other sources have been the cause of a large number of outbreaks of typhoid fever or other water-borne disease, and

"WHEREAS, check-valves and other protective devices, or notifying the public in the case of using water from a polluted source through an auxiliary intake or by diverting the flow around an integral part of a purification plant through a by-pass, cannot be depended upon to adequately protect the public from disease,

"BE IT RESOLVED, that no physical connections should be permitted between any potable public water supplies either through cross-connections, auxiliary intakes or by-passes and other supplies except as follows:

1. With another potable public water supply.

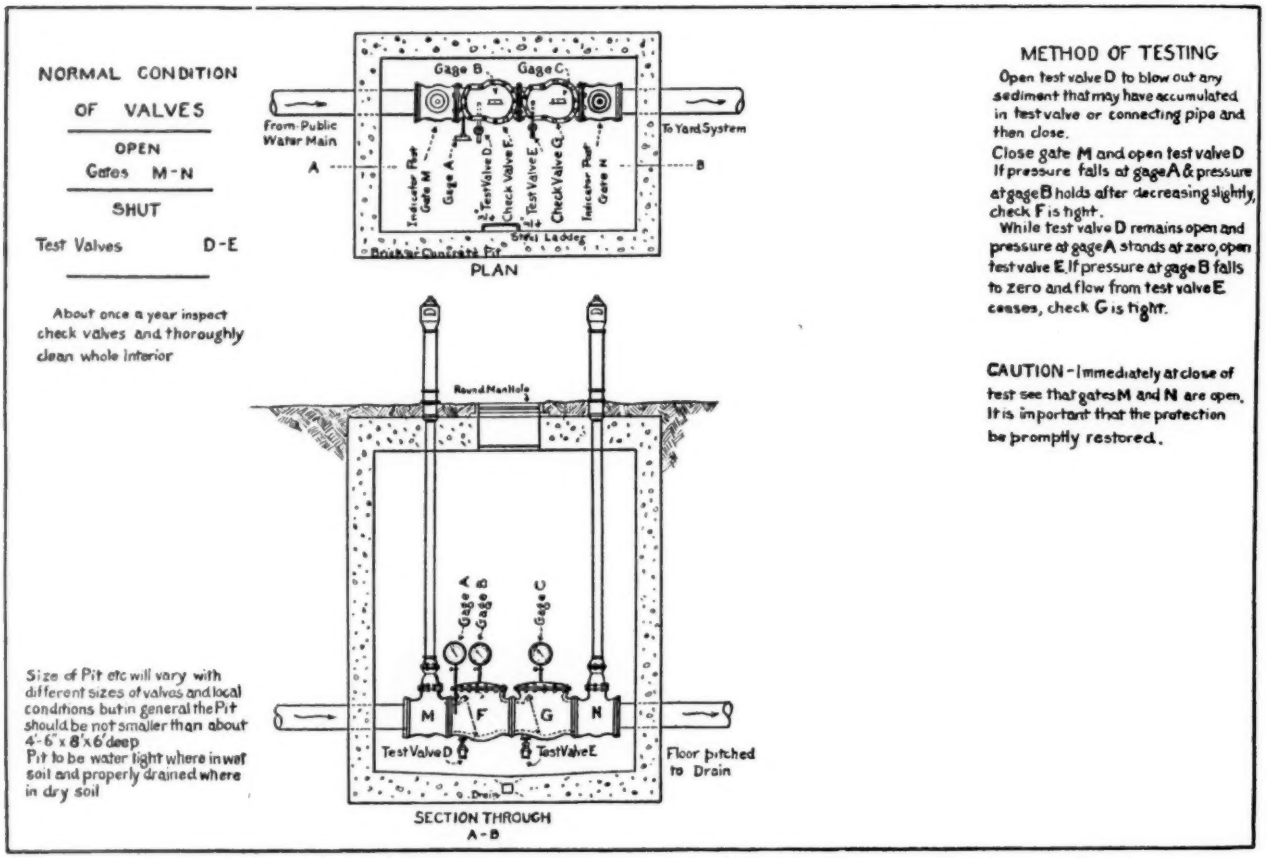
2. With a potable supply which is regularly examined as to its quality by those in charge of the potable public supply to which the connection is made.

"This prohibition to apply to all piping systems, either inside or outside of any building or buildings, and be it,

"FURTHER RESOLVED, that definite programs should be inaugurated in each state and each municipality thereof to permanently eliminate all other connections, and be it,

"FURTHER RESOLVED, that the Executive Committee of this conference transmit copies of this resolution to the Fire Underwriters Association and related organizations, also the American Water Works Association, New England Water Works Association and other analogous organizations with the request that they cooperate in securing the carrying out of the provisions of this resolution."

In its report which recommended this resolution for adoption by the Conference, the Committee defined cross-connections, auxiliary intakes and


NORMAL CONDITION OF VALVES
OPEN
Gates M-N
SHUT
Test Valves D-E
About once a year inspect check valves and thoroughly clean whole interior
Gage B
Gage C
From Public Water Main
To Yard System
A
B
Indicator Post Gate M
Gage A
Test Valve D
Check Valve F
Test Valve E
Check Valve G
Indicator Post Gate N
Steel Ladder
Bottom Concrete Pit
PLAN
Round Manhole
Gage A
Gage B
Gage C
M
F
G
N
Test Valve D
Test Valve E
Floor pitched to Drain
Drain
SECTION THROUGH A-B
Size of Pit etc will vary with different sizes of valves and local conditions but in general the Pit should be not smaller than about 4'-6" x 8' x 6' deep
Pit to be water tight where in wet soil and properly drained where in dry soil
METHOD OF TESTING
Open test valve D to blow out any sediment that may have accumulated in test valve or connecting pipe and then close.
Close gate M and open test valve D If pressure falls at gage A & pressure at gage B holds after decreasing slightly, check F is tight.
While test valve D remains open and pressure at gage A stands at zero, open test valve E. If pressure at gage B falls to zero and flow from test valve E ceases, check G is tight.
CAUTION - Immediately at close of test see that gates M and N are open. It is important that the protection be promptly restored.

Fire Service Connection Using Two Check-Valves—of Approved Type—Connecticut State Department of Health

by-passes; presented a tabulation of outbreaks of typhoid fever and in some instances of enteric diseases traceable to cross-connections, auxiliary intakes and by-passes. This tabulation includes a total of 8,028 cases of typhoid fever with 226 deaths and also more than 11,000 cases of enteric disturbances.

Appended to the report are the results of the questionnaire summarizing the procedure for elimination of cross-connections, etc. As an example of what may be done, the experience at Chicago may be cited. A survey disclosed 428 cross-connections of which 179 were direct and 249 indirect. By the end of 1925, 85.3 per cent of these connections had been removed.

Legal Liability.—The legal cases cited in the report of the state sanitary engineers support the position that municipalities that through their officers permit cross-connections with polluted supplies become legally responsible for any epidemics resulting therefrom. In the opinion of the Committee they become legally liable if the epidemics result from any negligence in the design, installation, operation or inspection of said connections. It is also true that equal, if not greater, responsibility rests upon state authorities regarding cross-connections even though it be moral rather than legal.

Relative Hazards.—In the 296 cases of interruption or failure of water supplies, recorded by the Association Factory Mutual Fire Insurance Companies, there were 12 cases where fires occurred simultaneously.

In the 8,028 cases of typhoid and over 11,000 cases of enteric disturbance, resulting in 226 deaths, the losses by death and disability reached millions of dollars. Most of the deaths followed pollution passing through single valves or checks.

Apparently no single valve on a connection between a potable and a polluted water supply affords sufficient protection, and even the best installation of double check-valves may fail for lack of inspection.

Importance of Inspection. — Where double check-valves are inspected frequently and where they are thoroughly overhauled annually, the danger due to cross-connections is greatly reduced. The permissibility of the best installation, other things being equal, therefore, hinges upon the frequency and kind of inspection.

Results of inspection of 1,032 sets of double check-valves by the Associated Factory Mutual Fire Insurance Companies showed only four cases where both valves were leaky, and in these four leakage was slight and due to lack of care. An instance has been cited*, however, where both clappers of a double check-valve installation were held partly open by a pair of overalls, thus again emphasizing the necessity for frequent inspection.

Data regarding cross-connections in New Bedford are of interest. Here the check-valves are inspected at least twice a year, and the results show both valves leaky in two out of 2,152 tests or less than one case in 1,000 inspections. Many of the installations were not of the latest type.

The results of the first year of periodical testing of double check-valves by the State Department of Health of Connecticut show that out of 624 tests on iron-body check-valves, there were 24 cases where one leaky valve was found and one case where both valves were found to be leaky because of unevenness in the flat, rubber seat-facings. Of 273 tests of the all-bronze valves, leaky valves (outside only) were found in 3 cases and in no case were both valves leaky.

In view of the large number of cases of sickness and death, the neglect of even the best devices is dangerous. No pains should be spared to make inspections thorough. The Committee realizes the difficulty in establishing a procedure that will prove effective for all conditions, all types of installation and all places. To indicate broad general principles rather than routine procedure seems to be the work of this committee. Nevertheless, it is believed that good results may be obtained by quarterly inspections. Furthermore, the Committee believes that, where possible, inspections should be made through the cooperative efforts of both state and municipal authorities on the one hand and the property owners and insurance companies on the other. Installations in each municipality should be examined by a state official or other competent water-works authority at least once a year.

The attention of water departments is called to the frequency of unknown and unprotected connections, not only as regards their existence but also as regards their type and condition. This relates particularly to old installations. All such connections should be sought out and, when found, should be abolished or protected.

The Committee appreciates the cooperation of the insurance companies as exemplified by the action of the Association Factory Mutual Fire Insurance Companies who are chiefly interested in the protection of factories and mills as contrasted with general fire protection. These companies at their executive meeting on Dec. 12, 1927, adopted the following procedure:

"a. See that every set of double check-valves, both old and new, receives the necessary supervision. Experience has shown that many risks do not appreciate the importance of keeping the double check-valves clean and tight by means of an annual overhauling. Our work would be in the line of education and assistance."

"b. Pending the decision in each case as to the final outcome, see at once that every single check-valve between potable and non-potable supplies is made accessible and kept tight as is being done in the State of Massachusetts."

"c. Make a study of fire-service connections at our plants both insured or prospective, and determine where it would be wiser to eliminate cross-connections and where best to provide other supplies. Then for those risks where cross-connections should be retained, have all-bronze double check-valves put in and provide for periodic and effective supervision of them as outlined in paragraph 'a' above."

As representing the attitude of other insurance companies the following may be quoted from a letter of George W. Booth, Chief Engineer, National Board of Fire Underwriters, published in the June 3, 1920, issue of the Engineering News-Record:

"The fire-protection engineer is not the responsible party in making the connection originally or in its continuance. Insurance standards require, for complete reliability, two independent sources of supply, and the plant management or the municipal authorities may, and often do, use one source which is unsafe or questionable from a sanitary standpoint, for the reason that it is a cheaper or easier one.

"The engineers of the National Board of Fire Underwriters do not, and we believe other engineers should not, favor such connections, but there are cases where they have already been made, and it is not possible, without the charge of discrimination, to refuse credit for them as emergency sources. It is, however, standard practice with many of the insurance bureaus to recommend secondary sources of supply which will be safe, as for instance, a storage reservoir.

"The double check-valve, designed some years ago for use on connections to sources of doubtful quality, has been permitted by some health authorities and has a satisfactory record. It should be installed most carefully and be maintained under a thorough inspection system."

Recent Developments in Chlorination.—A method of overcoming the dangers of cross-connections between safe and unsafe water supplies suggested in the past was to sterilize secondary supplies used for fire by installing chlorinators on fire-pump suctions. Fire pumps, however, are normally idle, being merely "turned-over" once a week to be sure that they are in operative condition; and once a year, during the summer, they are tested to capacity by means of hose lines attached to the yard hydrants.

A chlorinator attached to a fire pump, therefore, would normally be inoperative, and hence was not considered dependable, if called upon suddenly to operate in the emergency of a fire after having stood idle. Manu-

* Jour. N. E. W. W. A., Vol. XXVI, p. 406.

ally controlled chlorinators were also considered unreliable, because the operator of the pump, in the excitement of a fire, might forget to turn on the chlorine supply.

One manufacturer of water-works chlorinating apparatus has been at work on the problem, and has recently developed an automatic start-and-stop chlorinator, especially designed to be connected to fire pumps. This machine, which is of the vacuum type, utilizing liquid chlorine by reducing it to a gas, is so designed that a small auxiliary injector continually draws a small amount of chlorine gas and discharges it to waste, thus keeping the apparatus primed and assuring that it is always in operative condition. When the fire pump starts, a main injector draws the chlorine gas and discharges it in solution to the point of application of the fire-pump suction.

There is no need of proportioning the amount of chlorine exactly to the amount of water discharged, as is necessary in water-works practice, because the water delivered by the fire pump is not used for domestic purposes. The fire-pump chlorinator, therefore, discharges into the pump suction an amount of chlorine sufficient to care for the maximum draft from the pump, regardless of what is actually being delivered.

This chlorinator has been tested by the engineers of the New York State Department of Health. As a result of these tests, that department permits the retention of cross-connections under certain conditions, if chlorination is applied to the secondary supplies.

Conclusions.—The Committee recognizes that the only absolute safeguard for the purity of water supplies is complete separation of potable and non-potable supplies. Many cases exist in industrial as well as fire lines where cross-connections can be entirely eliminated without extensive changes or undue hazard to life and property. Such connections should be immediately abolished. In other instances the abolition of such cross-connections presents a very serious problem from the standpoint of possible loss of life and property by fire. Each case should be carefully studied on its own merits to determine the best procedure, all interests being considered. So far as possible steps should be taken in each community to provide public water supplies of sufficient adequacy and reliability, even to providing a secondary potable supply if necessary, so as to eliminate the necessity for cross-connections of any kind.

The Committee feels that pending the establishment of adequate and reliable supplies for protection of life and property from fire, experience to date indicates that double check-valves of the latest improved type, properly installed and adequately supervised, furnish the best protection of any single device now known. It is essential, however, that such installations be regularly and frequently inspected and tested. Installations of this type are relatively recent and whether or not such installations, give sufficient protection, is a question that is still open for decision on the basis of further experience.

The Committee is of the opinion that the recently developed chlorinator for auxiliary supplies offers another valuable means of defence against bacteriological contamination of public water supplies through cross-connections. However, the Committee believes that more experience must be gained with this device, before it can be unqualifiedly recommended. Properly operated and maintained, the device provides a method for making polluted auxiliary supplies, bacteriologically safe, even though such supplies might continue to be non-potable.

Your Committee does not approve the use of cross-connections between safe and unsafe supplies, and wherever auxiliary supplies are made safe by treatment there should be provided the additional safeguard of proper and properly installed and inspected double check-valves. Furthermore, these valves should be used between drinking water supplies and those that while unpotable,—like pure sea water,—do not require treatment to make them safe.

The Committee strongly urges that states adopt suitable laws and regulations covering the control of cross-connections and that in each community an investigation of the existing cross-connections be made immediately and a program for the elimination or control thereof be inaugurated by the local authorities. The Committee also urges that, where possible, the inspections be made through the cooperative efforts of state and municipal authorities on the one hand and owners and insurance companies on the other. Inspections of all installations of protective devices should be made at least quarterly by an official responsible for the quality of the public water supply and such devices should be overhauled yearly.

While this report is largely concerned with cross-connections for fire service, there are many other cross-connections like those with sewers, around water-purification plants and through auxiliary intakes. None of these should be permitted.

Your Committee recommends that the following resolution be adopted by the Association:

"WHEREAS, evidence shows that the existence of certain cross-connections between safe public water supplies and unsafe private water supplies, not equipped with modern protective devices, has resulted in many outbreaks of disease and many deaths, and

"WHEREAS, such cross-connections are a hazardous part of any water-supply system.

1. This Association recommends that no cross-connection be permitted with a supply that in the opinion of the State health authorities is bacterially unsafe.

2. This Association recommends that any cross-connection permitted with a bacterially safe but non-potable supply shall be made through a properly installed and adequately supervised, all-bronze, rubber-seated, double check-valve of a type approved by the State health authorities.

Ohio Sewage Treatment Conference

The second annual Ohio Conference on Sewage Treatment was held at Marion, Oct. 31, with attendance of about 100. Of the 85 municipal sewage treatment plants in Ohio, 41 were represented by one or more persons. There were also present a number of city officials having to do in one way or another with sewage treatment plant operation.

The program was to some extent diversified, the topic of sewer rental law and its practical operation receiving lively discussion. The latter portion of the afternoon was devoted to an inspection of the Marion sewage treatment works.

Officers elected for the ensuing year were: C. C. Hommon, Canton, chairman; G. E. Flower, Cleveland, vice-chairman; Floyd G. Browne, Marion, secretary-treasurer; F. E. Sheehan, Portsmouth, member-at-large of the executive committee.

No decision was made as to next year's meeting place, but a very cordial invitation was presented by the officials of Akron.

Mosquito Survey Under Way for Toledo, O.

A survey to find out what steps are necessary to rid Toledo of the mosquito nuisance has been started under the direction of Major E. M. Skinner of the mosquito control division of the Gorgas Memorial Fund.

The survey, which is being underwritten by the Toledo Chamber of Commerce, will include an investigation of polluted and stagnant pools and streams. When the survey is completed, the findings as to causes and an estimate of the probable cost of elimination will be presented to council. There is some possibility that the city and county might jointly finance the necessary expenditures to allow the people of Toledo and Lucas County to sleep in peace during July and August.

Boston Company Acquires Five West Virginia Utilities.—The Atlantic Public Utilities Corp., Boston, Mass., has purchased five water and electric companies in West Virginia. These are Weston Water Co., Glenville Electric Co., the St. Albans Water Co., the Dunbar Water Co., and the East Rainelle and Oak Hill Water Co.

Asphaltic Pavement Construction in the City of Pittsburgh, Pa.

Sub-Base Treatment, Base Proper and Top—Materials and Methods

By J. J. PAINE
Director, Pittsburgh Bureau of Tests

IN Pittsburgh we have hundreds of miles of good streets, and like every other large city, we have a few that are not so good. Pittsburgh has many difficult engineering problems and often a very short street will pass over sand, clay, shale, rock and filled ground with exceptional grades, and curves, along hillsides and ravines.

Causes of Failures.—Five years after the World War, we found a number of our streets breaking up. There were some unpleasant rumors. The contractors said it was due to poor materials, and the materials people blamed the cause on everything else. So we had an extensive investigation and numerous conferences.

Taking thirty streets that varied from one year to ten in age, our report was something as follows:

21 streets—poor workmanship and design.

7 streets—poor materials and design.

2 streets—poor inspection and design.

In every case we see design as one of the contributing causes. Our Engineering Bureau in Pittsburgh has as many capable and competent engineers as any city in the country. We were following standard practice for that time. Careful preparation of the sub-grade; a 6-in. 1:3:6 concrete base, with a standard block stone, brick or asphalt top.

Now please do not jump to conclusions. I am talking about heavy traffic streets. We have numerous residential streets built on this method, 15 years or more old, and still giving excellent service. Also allow me to explain more at length the nature of these failures.

Base Failure Due to Heavy Loads.—In 90 per cent of the cases, the cause was base failures; the pavement had worn out from the bottom up, rather than from the top down. The street had failed under the terrific demands of increasing traffic. We also noted, that in nearly every case where there was a failure, that the sub-grade had sunk, shifted or in some way changed from its original contour. I might add, that at this time, there were hundreds of solid tired trucks hauling coal, steel, gravel, cement, etc., with loads of from 10 to 15 tons and some even higher. At present we are trying to limit tonnage and make all trucks use pneumatic tires.

Experiments conducted by our laboratory indicate that the impact of a truly solid wheel tire varies in force in approximately the same ratio as that of the force imparted by a free falling body. Thus we see that heavy solid tired trucks, having chains on, will give continuous impacts of from six to eight times its dead load, per rear wheel. Often these stresses set up in a pavement are above the strength of the materials and unless properly distributed the result is failure of the pavement.

For the last ten years many of us have been attending concrete, brick, asphalt, and other association meetings all over the country and it is only on rare occasions that we ever hear someone suggest that a proper foundation should be put under a pavement. That is supposed to be an axiom but in many cases, I find it to be only a postulate. We discuss this and that kind of pavements, extol its virtues, and go along our way as if it can be placed on thin air. Perhaps there is little discussion of sub-grades and sub-bases, because there is no association in their behalf, but I believe it would be well for representatives of different associations and material salesmen, to study, design, and work out for their respective districts and communities the proper kind of foundations for local conditions and materials; it would often save many embarrassing explanations and excuses for failure of their materials.

Sub-Grade Preparation.—So if we are going to make any real attempt toward constructing an Ideal Pavement, the first thing to be considered is the foundation. We speak of adequate drainage. The drainage facilities should always be more than adequate. Next, proper preparation of the sub-grade. Unless the sub-grade is thoroughly stable, that is, will resist temperature and moisture changes under all conditions, it has not had proper preparation. A sub-base treatment should then be resorted to.

In the Pittsburgh district the sub-soil is principally clay. On account of the fact that clay soils have certain undesirable characteristics as regards their behavior under influence of moisture and temperature, they cause much trouble in pavements which are laid on them. This holds true regardless of the type of pavement. Consequently, many experiments, with stone, gravel, and slag, have been tried in order to find some way of eliminating or at least conteracting or reducing these harmful effects.

One way is the use of a cushion blanket of granulated slag 3 or more inches deep. This method seems fairly successful when held between curbs.

Another method is to mix a granular material with the clay instead of compacting it in a layer over the clay. I refer to the method developed by Prof. H. Eno of Ohio State University. Also, A. T. Goldbeck, 1924, American Association of State Highway Officials.

In the past we used a rather coarse aggregate ranging from 1½ in. to 3 in. The aggregate was placed in two layers with a total thickness as shown on the contract plans, which is ordinarily 3 in. in thickness. The first layer is thoroughly rolled in to and incorporated with the sub-grade. The second layer is then spread and rolled until creeping before the roller ceases and all the material is locked or keyed. After this second rolling the voids in the top layer are filled with aggregate ranging from ¼ in. to ¾ in. and thoroughly consolidated by rolling.

More recent experiments with hard air cooled slag have given excellent results. The principle involved here is exactly the same as that in the construction of so-called "traffic bound" roads. This principle is that of increasing the internal friction in the sub-base and hard air-cooled slag is apparently giving the best results; this is probably due to the rough surface texture of the slag particles which must necessarily give greater friction than would smooth surfaced particles of the same size.

The advantages of a sub-base treatment are several. First, it gives a permanent even and uniform solid foundation. Second, it can be cut into if necessary and again repaired without great difficulty. Third, it forms an effective drain whereby the water may be carried to the curb drains and prevent saturation of the base. Fourth, it forms a moisture barrier between the sub-soil and base and prevents continued transmission of moisture by capillary attraction. Fifth, more uniform conditions, with especial relation to moisture. Six, increased bearing power which helps to distribute stresses and absorb heavy impacts.

The Base.—The base proper, which is usually concrete or reinforced concrete, needs but little discussion at this time as all engineers are familiar with the latest methods of design and construction. However, I wish to state that I am not in sympathy with local

mixes. Anything leaner than a 1:6 (approximately 1:2:4) mix has proven extremely unsatisfactory in Pittsburgh. Also, without going into the mechanics and mathematics of the problem, I believe that nothing less than an eight in. base should be used for heavy traffic streets.

Perhaps, in the next few years, we may see considerable changes in the base types. A base that is rigid, strong, resistant to moisture, more free from expansion and contraction stresses, yet more flexible, and easier to cut into and repair.

Slag Aggregate for Binder.—In Pittsburgh, we have a decided preference for sheet asphalt as the result of many experiments and practical experience. The usual 1.5 in. binder and 1.5 in. wearing courses are used. The coarse aggregate for the binder course is slag, having the following requirements: Slag shall consist of air cooled blast furnace slag of clean, tough, durable pieces, non-glassy in character. Dried slag when tested according to the methods of the American Society for Testing Materials, Serial Designation, C 29-27, shall weight not less than 70 lb. per cu. ft. All the material must be retained on a 10 mesh screen.

At least 25 per cent shall pass a ⅜ in. circular opening; at least 30 per cent and not more than 50 per cent shall pass a ⅝ in. circular opening and be retained on a ⅜ in. screen; at least 90 per cent shall pass a 1-in. opening; and 100 per cent shall pass a 1¼-in. circular opening.

We have found slag to be the most satisfactory of all our local materials and have between 300 and 400 miles of binder laid with this material.

The bulk of our sand has been a well graded silica lake sand.

The Filler.—The filler has been limestone or silica dust. For the last five years we have obtained very satisfactory results with silica dust, a by-product from glass plants. We have used this as a filler up to fairly high percentages. Its grading is approximately as follows:

	Per Cent
Passing 300 mesh sieve	81.5
Passing 200 mesh sieve	90.0
Passing 80 mesh sieve	98.0
Passing 50 mesh sieve	100.0

All asphaltic cement used met the regular standard specifications.

The Binder Mixture. — The binder composed of coarse aggregate, sand and asphalt was mixed in approximately the following preparations:

	Per Cent
Asphaltic cement	4.0 to 6.5
Fine Aggregate	20.0 to 35.0
Coarse Aggregate	58.5 to 76.0

With at least 25 per cent of the fine aggregate retained on a 40 mesh screen.

Oftentimes there seems to be a tendency towards laxity when preparing and laying binder, but as much care in the preparation and placing of binder should be exercised as in that of the wearing course. Design of mix, temperatures, raking, compression, thickness, and even contour should be carefully adhered to. The binder is not just a filler to bring the streets to established grade; it is a foundation, and unless there is a definite bond between the binder and the base, and the binder and the top, it is not fulfilling its purpose.

This year the City of Pittsburgh definitely adopted the high dust filler and void theory of design for wearing surface on heavy traffic streets. Our mixture contains the average preparations as follows:

	Per Cent
Bitumen soluble in carbon tetrachloride	8.5 to 10.5
Bitumen soluble in carbon tetra-4	NU NU U
Dust passing a 200 mesh screen	18.0 to 30.0
Sand passing a 80 mesh screen	15.0 to 25.0
Sand passing a 40 mesh screen	20.0 to 35.0
Sand passing a 10 mesh screen	15.0 to 25.0
Sand passing a 4 mesh screen	0 to 5.0

Preparing Wearing Surface. — Our specifications for preparing and laying wearing surface are as follows:

The sand and asphalt cement shall be heated separately. The temperature of the asphalt cement shall be maintained between 300 and 350 F. at the discharge pipe. The temperature of the sand in the mixer-box and after adding the filler, shall not exceed 450 F. Specified proportions of filler and hot sand, determined by weight, shall be immediately mixed in an approved mixer. Then shall be added the hot asphalt cement in the stipulated proportions and the whole mixed for at least one and a half minutes or long enough to effect a thoroughly homogeneous mixture.

In preparing the wearing course mixture in a pug-mill mixer, the combined weight of mineral aggregates, including filler plus asphalt cement, shall not produce a volume of material in excess of that which will find its normal level in the mixture-box slightly below the top of the mixer blades when said blades are exactly vertical.

Laying Wearing Surface.—Upon the binder course shall be laid the wearing course as described below.

The asphalt wearing surface shall be hauled to the work in trucks equipped with canvas or other suitable covers and shall leave the plant at a temperature of between 375 and 425 F. as suitable for the asphalt used and air temperature. Upon arrival at the street, it shall be deposited at least 10 ft. ahead of the work, upon the clean binder or a movable platform from which all mixture shall be distributed to the place where it is to be raked. The temperature of the mixture shall be not less than 350 F. The shovelers shall carry each shovelful to its place, in front of the rakers, and turn it over as deposited. Rakers shall not be allowed to walk in the hot mixture. The hot mixture shall be uniformly distributed and thoroughly raked to full depth upon the asphaltic binder (which shall be thoroughly dry, free from leaves or other foreign matter) so that after receiving its ultimate compression by rolling, it shall have an average thickness of 1.5 in. Any material that is lumpy or does not break down easily must be wasted. Immediately after the mixture is raked it shall be luted transversely of the pavement by means of a lute 5 to 6 ft. long, operated from the sides of the pavement. Strokes with the lute shall overlap each other at least 2 ft., and shall extend beyond the center of the pavement. The initial compression shall be effected by means of a three wheeled roller, weighing not less than 12 tons, used longitudinally to the pavement, after which a small amount of portland cement shall be swept over the pavement. Rollers must get on to the work as soon as practicable. Final compression shall be effected by means of a tandem roller weighing not less than 10 tons. Rolling shall be steadily kept up at the rate of not more than 200 sq. yds. per hour until all roller marks shall have disappeared and the surface gives indications of no further compressibility, and free from elevations and depressions more than ¼ in. under a 6 ft. straight edge placed longitudinally to the pavement. Roller paths shall at all times overlap by half the width of the roller.

The mixture after final compression shall show a density by the specific gravity method of not less than 85 per cent of the specific gravity of the mineral aggregates contained therein.

The mixture shall average not less than 155 lbs. per sq. yd. of surface.

No mixture shall be laid in the rain or when the binder has water standing upon it or when the weather conditions are unsuitable. Care should be taken to apply water to the roller wheels in just sufficient quantity to prevent hot mixture adhering, and with no excess so as to cause blistering. All blisters must be broken up with a rake or raked out and replaced with fresh material. Cross and diagonal rolling should not be undertaken until the mixture will stand same without checking and such rolling shall be done only with the tandem rollers.

The notion of the roller shall at all times be slow enough to avoid displacement of the hot mixture and any displacements occurring as a result of reversing of the direction of the roller or from any other cause, shall be corrected by the use of rakes and fresh material where required. For a radial distance of 8 in. around all structures, manholes, curbs, gutters, or other locations, inaccessible to the roller, the compression shall be effected with hot iron tampers weighing not less than 25 lbs. and having a bearing area not exceeding 48 sq. in.

The roller shall be weighed. The roller wheels shall be tested with a straight edge in order to detect untrue surfaces.

Badly worn bearings shall be replaced before the roller is used as a

defective roller will cause a wavy and untrue surface.

There shall be a positive bond between binder and top.

These are a few of the many details that must be constantly emphasized in asphaltic work.

Asphaltic Cement.—Our asphaltic concrete is of the familiar fine graded type having the following composition:

	Per Cent
Bitumen	5.5 to 7.5
Aggregate passing 200 mesh sieve	8.0 to 12.0
Aggregate passing 80 mesh sieve	6.0 to 15.0
Aggregate passing 40 mesh sieve	10.0 to 20.0
Aggregate passing 10 mesh sieve	10.0 to 20.0
Aggregate passing ⅜" screen	15.0 to 30.0
Aggregate passing ⅝" screen	5.0 to 20.0
Aggregate passing ¾" screen	5 to 15.0

Screen: Circular openings.

The coarse aggregate used in the asphaltic concrete is slag as we have found this to be the most suitable of our local materials. We have many miles of slag asphaltic concrete which have given excellent service under heavy traffic for 10 to 15 years.

Acknowledgment.—The foregoing is an abstract of a paper presented at the 7th Annual Asphalt Paving Conference held at New Orleans, La., Dec. 3-7, 1928.

Chemical Treatment at Kansas City

Method of Water Purification at City Plant Outlined

By GEO. F. GILKISON

Chief Chemist, Water Department, Kansas City, Mo.

THE Kansas City, Mo., water department takes its supply from the Missouri River. This is a highly polluted surface supply, carrying a large amount of suspended matter.

Suspended Matter.—The suspended matter in the Missouri River varies over a very wide range, both with regard parts per million and coefficient of fineness. The turbidity of this stream varies from 15 parts per million in the winter, when the river is frozen over, to 18,000 parts per million in the spring, when the ice breaks up. The coefficient of fineness of suspended matter varies from 0.8 to 1.5, based on the A. P. H. A. standard.

Dissolved Solids.—The concentration of dissolved solids also fluctuates, varying from 300 parts per million in the spring when the river is high, due to snow water from the upper watershed and spring rains over the lower portion, to 540 parts per million when the river is at its lowest level in the winter. The Missouri River watershed covers approximately 430,360 square miles.

Color.—The Missouri River carries very little dissolved coloring matter, and at no time of the year is it a factor in computing the required chemical dose.

Hardness.—Ours is a comparably hard surface supply. The total hardness varies from 148 parts per million to 296 parts per million, expressed in terms of calcium carbonate. The average total hardness for the past year was 219 parts per million, of which 148 parts per million were due to calcium and magnesium bicarbonate, and 70 parts per million to calcium and magnesium sulphates.

B. Coli Index.—The B. Coli index of the Missouri River is very high at Kansas City, ranging from 50 per 100 c.c. to 100,000 per 100 c.c. completely confirmed.

Industrial Waste.—This division is indeed fortunate that, with all the industrial waste being discharged in the Missouri River, none of them, to date, had directly or indirectly interfered with our purification process. The characteristic odor and taste of chlorine, that you have doubtlessly all noticed in our city water supply, cannot truthfully be charged to industrial waste, but is the direct result of trying to maintain open storage basins in our industrial districts.

Chemical Treatment.—The chemical treatment at Kansas City consists of presedimentation, followed by coagulation with alum and lime, and sterilization with liquid chlorine.

Presedimentation.—With a raw supply carrying as high as 18,000 parts per million turbidity, it necessarily follows that presedimentation is an important step in purification here. At the Quindaro Purification Works the raw water is pumped into a 4,750,000 gal. basin, known as the horseshoe basin, or basin No. 1. It flows from this basin into basin No. 2 over a weir, in front of which is a stilling baffle. This basin has a capacity of 14,250,000 gal., making a total of 19,000,000, which is 4½ hours retention, based on 100,000,000 gal. daily pumpage. These basins are flushed regularly, but nevertheless they soon fill up with sludge, necessitating their being cut out of service and washed. Three hundred and thirty thousand six hundred and sixty-five tons of suspended solids were removed from the water in the Quindaro basins last year, 298,241 tons of which were removed in the preliminary basins, that is, 90 per cent of the basin load was carried by the preliminary basins. At the North Kansas City Purification Works we have four 4,000,000 gal. circular preliminary basins equipped with Dorr mechanical clarifiers. This gives four hours' retention, based on 100,000,000 gal. daily pumpage. This equipment provides for the continuous removal of the sludge, and eliminates the necessity of cutting units out of service for washing. The new North Kansas City Purification Works have been in service but a short time, and have been operating much below rated capacity. For this reason no attempt will be made to quote efficiency at this plant.

Application of Chemicals.—At the Quindaro plant the alum and lime are applied to the water through perforated lines as it passes over No. 2 weir; that is, as it passes out of the presedimentation basin. The water then enters a short mixing chamber, with a retention period not exceeding one minute. It then enters the coagulation basins, where it remains 17 3/10 hours, based on 100,000,000 gal. daily pumpage. It is chlorinated as it leaves these basins, and is pumped to the distribution station. No filters are provided at the Quindaro Purification Works. The average raw water turbidity for the past year was 3,100 parts per million, and the delivered water 10 parts per million, or an average of 99.68 per cent removal by sedimentation and coagulation alone.

Approximately 5,000,000 lb. of alum was used by the water department last year, all of which was manufactured by the department. The total cost of manufacturing alum for the past year was $16.22 per ton, delivered to the storage bin. The dose of alum varied from 4.26 grains per gallon to 0.58 grains per gallon, the average over the year being 1.67 grains per gallon. The lime used was lump quick lime, containing an average of 92 per cent water soluble calcium oxide. The dose used varied from 2.33 grains per gallon to 0.29 grains per gallon, the average for the year being 0.84 grains per gallon.

It will be noticed that the dose of lime is approximately one-half that of alum. This is the ratio we use most of the year. With an average hardness of 219 parts per million, it seems the addition of lime, purely for aiding coagulation, would be unnecessary, but experience has shown us that a much smaller dose of alum may be used, if approximately one part of lime is used to two parts of alum.

Chemical Cost.—The chemical cost of purification for the past year was $2.94 per million gallons, delivered to the city. This is the cost of chemicals alone, and does not include handling cost.

In view of the marked contrast in methods and equipment at the Quindaro and North Kansas City Purification Works, it is indeed unfortunate that enough operating data on the new plant is not at hand for comparison of efficiency and cost, but it is impossible to compute the efficiency of a hundred million gallon daily plant from the results obtained by operating it at one-fourth rated capacity.

Acknowledgment.—The foregoing paper was presented at the recent meeting of the Missouri Valley Section of the American Water Works Association.

The Sewage Treatment Plant of the Bloomington and Normal Sanitary District

How Two Illinois Cities Solved Their Sewage Disposal Problem

By CHARLES CARROLL BROWN
Associate Editor, Municipal News and Water Works

IN the earlier sanitary history of Bloomington, Ill., when it was perhaps half its present size, combined sewers were built, some of them by engineers who had the idea that open joints were preferable for such sewers, although the soil is the usual Illinois clayey loam with an occasional lense of more porous material. Perhaps as a consequence, straight grades were not thought to be necessary and it was reported that there were long pools of standing sewage in the system during periods of dry weather. The consequence of such pools was very evident at the untrapped storm water inlets and such manholes as have perforated covers. One engineer tried to cure the evil by inventing what he called a stench trap, which was a cast iron plate over a rectangular channel in the gutter at the catch-basin, with flap at each inlet from the gutter. The plate served as a gutter crossing for foot passengers at a street corner and the flaps were supposed to serve to retain the odorous gases in the sewer system. It is needless to say that the refuse brought to the catch basins by storm water propped open the flaps so that the neighbors complained bitterly of their inability to occupy their front porches on warm summer evenings.

In the years that have passed repairs to many sewers have removed some standing pools but that there are still some left is evidenced by the odors still given off at times through the untrapped storm sewer inlets, and by the dark color of the sewage delivered at the new sewage disposal plant, which was put in operation early last summer.

The Situation at Bloomington.—Bloomington and Normal are twin cities on the same drainage watershed and when sewerage and drainage conditions became troublesome in Bloomington it was manifestly unjust to put the whole cost of the main drainage system on the former city, through which Normal had its only practicable outlet. The situation was particularly troublesome to Bloomington because its water supply was obtained from wells in strata of porous material in the narrow drainage valley formed at and below the junction of two creeks which are the surface water drains and to some extent the underground water drains of Normal and of a considerable portion of Bloomington. These porous strata are at different depths and furnished various qualities of water, but those furnishing the best water were so near the surface that they were in danger of pollution by the slowly increasing sewerage system of Normal, whose only outlet is the stream mentioned.

Until 1917, however, nothing could be done officially to remedy conditions as to drainage and these two cities were among those active in securing the enactment by the legislature of that year of the Sanitary District Law of Illinois.

Formation of Sanitary District.—The Bloomington and Normal Sanitary District was established under this law in 1919 as the result of a vote of the taxpayers in the proposed district and much strenuous work by progressive citizens having the welfare of the cities at heart, and backed by the efforts of the State Department of Health with its experts, and others. The Trustees elected are John W. Harber and John J. Condon of Bloomington and W. W. McKnight of Normal, outstanding citizens of the district, having the full confidence of their constituents.

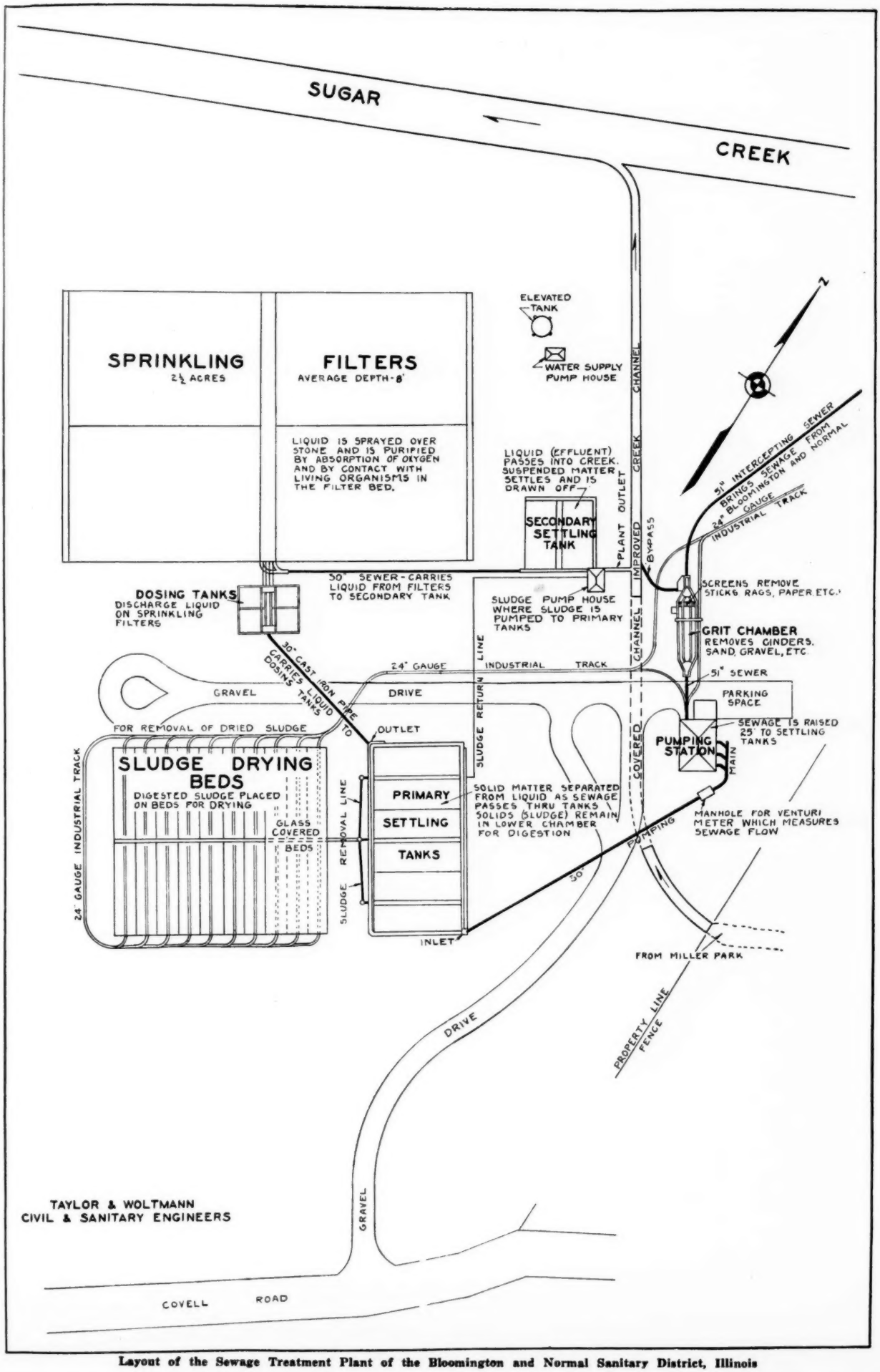
A preliminary study of the water pollution, sewerage and drainage problems of the cities was made by a well-known firm of engineers, which offered a full and promising solution for all of them but seems to have been more expensive than the citizens were willing to pay for.

The commissioners of the sanitary district took up the sewerage problem separately and now have their solution of it in what may be termed the trial stage of operation, and promising to be equal to others of the same sort under the same conditions, if not superior in some respects. They have done some necessary things toward the proper control of the surface drainage of the district and have attacked the problem of separating the sewage from the storm drainage in the existing combined sewers as well as by means of separate systems of storm drains and sanitary sewers in the newer parts of the cities.

The water supply problem is being attacked by a corporation formed by public spirited citizens who propose to secure a surface water supply, the cost to be borne by a bond issue of the corporation which will ultimately be taken up by the payment of rentals by the city and by the profits on water rates when the water works will become the property of the city. In this case the City of Bloomington will be the business operator and Normal will, if it chooses, become a wholesale customer, retailing water to its own citizens.

Design of the Plant.—A bond issue of $700,000 by the Sanitary District was voted in October, 1925, after some campaigning, with which to build the proposed sewage treatment plant and other works required in connection with it. Taylor and Woltman were selected as engineers, the former being a local engineer and the latter a young man of considerable experience in sewerage operations. They were given full opportunity to study their problems and to secure all the data thought necessary to make application of well established methods to the particular conditions at Bloomington. The result is a standard design including bar screens, grit chambers, pumping sewage up 25 feet through a Venturi meter to Imhoff-type primary settling tanks with upper story flow-through chambers dropping the settlings into digestion tanks or chambers below from which gases arise in the gas chambers to escape into the air or to be gathered and burned; sludge drying beds, dosing chambers distributing clarified sewage to sprinkling filters with broken stone as filtering material, secondary settling basin, small sludge pumping plant to pump sludge from secondary basin to primary sludge digestion chambers, the fully clarified effluent discharging through an improved concrete lined creek channel to Sugar Creek, a larger and as yet unimproved channel. The system need not be described in detail at this time except as to features which are peculiar to this plant and show how modern engineers modify standard practice to fit special conditions.

The accompanying diagram shows the direct flow of sewage and sludge by perhaps the shortest journey possible, entering from the north and flowing round the plant in the direction of the hands of a watch so that the treated and clarified sewage from the secondary settling basin enters the improved creek channel at a point opposite the short by-pass from the screen chamber; and the dried sludge is found at the south side of the plant at the most convenient place for removal, whether used for filling low ground about the plant or sold to farmers and removed by way of the road, which, by


SUGAR
CREEK
SPRINKLING
2½ ACRES
FILTERS
AVERAGE DEPTH-8'
LIQUID IS SPRAYED OVER STONE AND IS PURIFIED BY ABSORPTION OF OXYGEN AND BY CONTACT WITH LIVING ORGANISMS IN THE FILTER BED.
ELEVATED TANK
WATER SUPPLY PUMP HOUSE
LIQUID (EFFLUENT) PASSES INTO CREEK. SUSPENDED MATTER SETTLES AND IS DRAWN OFF
SECONDARY SETTLING TANK
PLANT OUTLET
IMPROVED CREEK CHANNEL
BY-PASS
51" INTERCEPTING SEWER BRINGS SEWAGE FROM BLOOMINGTON AND NORMAL
24" GAUGE INDUSTRIAL TRACK
30" SEWER - CARRIES LIQUID FROM FILTERS TO SECONDARY TANK
DOSING TANKS
DISCHARGE LIQUID ON SPRINKLING FILTERS
SLUDGE PUMP HOUSE WHERE SLUDGE IS PUMPED TO PRIMARY TANKS
SCREENS REMOVE STICKS RAGS, PAPER ETC.
GRIT CHAMBER
REMOVES CINDERS, SAND, GRAVEL, ETC.
30" CAST IRON PIPE CARRIES DOSING LIQUID TO TANKS
24" GAUGE INDUSTRIAL TRACK
51" SEWER
GRAVEL
DRIVE
PARKING SPACE
SLUDGE RETURN LINE
FOR REMOVAL OF DRIED SLUDGE
OUTLET
SEWAGE IS RAISED 25' TO SETTLING TANKS
PUMPING STATION
MAIN
SLUDGE DRYING BEDS
DIGESTED SLUDGE PLACED ON BEDS FOR DRYING
24' GAUGE INDUSTRIAL TRACK
GLASS COVERED BEDS
SLUDGE REMOVAL LINE
PRIMARY SETTLING TANKS
SOLID MATTER SEPARATED FROM LIQUID AS SEWAGE PASSES THRU TANKS SOLIDS (SLUDGE) REMAIN IN LOWER CHAMBER FOR DIGESTION
COVERED
MANHOLE FOR VENTURI METER WHICH MEASURES SEWAGE FLOW
PUMPING
30"
INLET
FROM MILLER PARK
PROPERTY LINE FENCE
DRIVE
GRAVEL
TAYLOR & WOLTMANN
CIVIL & SANITARY ENGINEERS
COVELL ROAD

Layout of the Sewage Treatment Plant of the Bloomington and Normal Sanitary District, Illinois

the way, is about 15 feet above the level of the sludge beds.

The plans for the pumping stations bear the name of Associates of J. L. Pillsbury, a firm of architects in Bloomington, continuing the notable work of the deceased founder of the firm. Stanley Pinel, who was employed by Taylor and Woltman on the preparation of the plans became later the resident engineer on construction and since putting the plant in operation has been superintending it to determine how closely it approaches to the efficiency for which it was designed. A visit during the summer showed satisfactory action and the test under the more difficult conditions of the winter season is now under way. J. L. Simmons Company of Bloomington are the contractors, who have recently finished the cleaning up and adjustment of the plant under Mr. Pinel's direction.

Sewage Collection System.—The area of the Bloomington and Normal Sanitary District is about 8.5 miles, comprising practically all of the two cities. There are about 80 miles of sewers, carrying from 6 inches to 96 inches diameter. These sewers discharged into Sugar Creek in its passage through the two cities, through nine outlets. An intercepting sewer 2 miles long was built to take the ordinary flow of sewage and the first storm water washings from the streets. It taps all the outlets, the upper end taking the sewage from Normal in a 27-in. pipe, which increases in size as the various outlets are reached until it becomes a 51-in. vitrified segmental block sewer, which enters the disposal plant from the north. A dam was built across the invert of each of the combined sewers, high enough to turn the sewage and the proper proportion of storm water into the intercepting sewer, all flow in excess overflowing into Sugar Creek. It is believed that the dilution of sewage by storm water, thus provided for, will be sufficient to prevent any nuisance in Sugar Creek. If not, change in height of dam in sewer can be made to insure greater dilution as the amount of sewage carried by such sewer may increase in the future.

The new plant is designed for a population of 54,000 people, fully twice the population now actually connected with the system, and by proper operation can handle considerable overload, including such as may come when the storm flow is at its peak. There is plenty of room, and the plans provide for doubling the capacity of the plant as constructed, by duplicating the settling tanks, sludge beds and sprinkling filters, on favorable ground adjoining the present respective structures. Space has been provided in the buildings for the necessary additions to pumping capacity.

Location of Treatment Plant.—As is so often necessary, the plant is located on a low flat alongside which the main drainage outlet of the cities runs, Sugar Creek, and through which a small stream runs draining a small area occupied in part by a thinly settled section of the city and in part by garden areas. The channel of this small stream has been improved with concrete bottom and walls for about 500 ft. to the point of entrance into it of the outlet from the secondary settling tank, and the bypass of the unpurified sewage in case of necessity. For about 250 ft. in the higher ground within the plant the creek is covered, the shortness of this covered section showing economy in design. Above this the channel is open up to the east boundary of the city property. The low ground within the property is protected by levees from overflow by storm-swelled Sugar Creek until it can be filled by the odorless sludge or acceptable refuse and waste dirt from outside excavations. The extension of the plant shown in the plans, will ultimately reduce the suggested filling to a reasonably small amount.

The 30-in. cast iron main, through which the sewage from the grit chambers is pumped up to the primary settling tanks, crosses above the covered channel of the small stream and is the only instance of the crossing of main lines of flow, in the design. There are, of course, some crossings by water pipes and drain tile.

The soil on the lower portions of the site is 4 to 10 ft. of black loam underlaid bywater bearing materials, mixtures in varying proportions of brown-black soil, yellow clay, sand and gravel, some of the 35-foot drill holes showing blue or other firm clay. The primary settling tanks are set on sloping bank with difference of elevations of about 7 feet, putting the bottom of the excavation for the tanks not far under the water level and some 4 ft. higher than the bottom of the secondary settling tank and the pump-house. The other structures are on or near the surface of the ground. The small area of the pump-house required excavation 18 ft. below the surface of the ground, the maximum of any structure in the plant. The advantage of delivery of the sewage to the pumps at a level up to 10 ft. above the pump center. The location of the structure is such as to have reduced the cost of excavation close to a minimum.

Motor driven centrifugal pumps of 4, 4, and 6 million gallons per day capacity have been installed and there is room for another when future demands require it. The 51-in. inlet from the grit chambers enters the pump well near its top and the outlet pumping main leaves the station at about the same elevation. All drainage in and about the house enters a 36-in. sump in the corner of the pump room under the stairway and is removed therefrom by an automatic electric bilge pump.

Flow of Sewage Through Plant.—The 30 in. pumping main raises the sewage about 25 ft. and delivers it at one corner of the battery and six primary settling tanks, each 28 ft. 4 in. wide and 90 ft. long and 29 ft. 6 in. to bottom of hoppers. The sewage may be turned to flow in a channel along one end of the tanks or along the side of the end tank and then along the other end of the tanks, thus giving ready reversal of flow through the tanks. The width of this channel decreases as each inlet to a tank is passed, from 3 ft. at the entrance to 18 in. at the farther end. Sewage is let into each flow through chamber by a 12 in. pipe leaving the bottom of the inlet channel and discharging at a depth of about 4 ft. below the water surface, depending on the position of the adjustable outlet weirs of the tanks. Each inlet pipe is controlled by a circular sluice gate over its end, operated from stand on walk-way above.

Between these inlet channels and the tanks are located the outlet channels into which the settled sewage flows over adjustable weirs 6 ft. long. These outlet channels increase in size in the direction that the inlet channels decrease from a width of 2 ft. to one of 4 ft. The inlet and outlet channels together occupy a bracket on the outside wall of the tanks, which is 7 ft. 10 in. wide overall.

Between the double walls of each alternate pair of tanks is a space partly filled with sand on which rests a concrete channel into which flows the sludge brought up from the tank hoppers by cast iron pipes and from which by pipes and channels it reaches the sludge drying beds and is distributed over them. The valves opening the sludge pipes are operated by hand wheels on the sidewalk above. This sludge channel should be very easy to clean after each drawing of sludge.

Among other items deserving special mention as convenient accessories to the plant are the full supply of water under pressure from the water supply pump house shown on the sketch, and the elevated tank so that every part of the plant can be kept clean and can be washed out thoroughly in case of stoppage by anything but ice. This winter will be a better criticism of the ability of the sewage to resist the fall of the thermometer than any which can be written at this time.

Glass Roof Over Sludge Drying Beds.—The greenhouse roof over the first six of the 20 sludge drying beds, and the possibility of supplying additional heat to that of the sewage and the sun, if necessary, will take care of a situation which might give considerable trouble without these provisions if the best action of the settling basins requires drawing of sludge at any time during the winter. Unless the weather is too erratic, it should be possible to make drafts of sludge from the tanks at times when the weather conditions are favorable to rapid drying of the sludge under glass cover, and not otherwise. A provision of grooves in the walls of the gas-chambers of the settling tanks has

been made so that if desired covers can be put on which will slope to a central tube leading the escaping gases to storage tanks (not yet provided for) to use as fuel for any desired purpose. There will be plenty of use for heat about the plant, for the best results in this case as well as for other purposes. Proper treatment promises so far to prevent the formation of odorous gases about the plant or to decompose them before letting them go, in case their conservation for use as fuel is not decided upon.

The dosing tanks are automatic, four in number, alternating in pairs, each pair serving one of the two sets of sprinkling filter beds. The 30 in. delivery pipes through the gallery between the filter beds reduce in size as each branch to a sprinkler lead is passed until they reach 16 in. diameter at the farther end. The branches through the beds are each of 8 inches diameter with standard ⅞ in. orifice sewage nozzles 14 ft. apart, the first being 11 ft. from the central gallery and the last being a half-nozzle, 4 ft. from outer gallery and just before the 8 in. pipe reduces to a 4 in. connection with outlet and with wash-water pipe.

The collection channels on the bottom of the filters are in the concrete base, trapezoidal in section, 3 in. deep by 9 in. in top width. They are covered by bricks, 1½ by 4 by 13 in., set on edge and alternating so as to leave 1½ by 13 in. spaces through which the water percolating through the stone reaches the channels.

The Specifications.—The brevity of the engineering specifications deserves attention. The specifications for materials occupy 7 pages of ordinary textbook size, printed in the large, 11-point type common to such books. They 22 items or paragraphs, liberally spaced on the pages. Sewer pipe and blocks, concrete materials in detail, steel for various uses, cast iron, lumber, expansion joints, valves and special appurtenances are all covered. The specifications for construction are equally brief and comprehensive. Excavation, backfilling, laying sewer, block or pipe, water pipe, concrete, placing valves, gates, etc., in full detail occupy not quite 19 similar pages, covering work done at unit prices. Such items as grit chamber, the engineering portion of the pumping station, primary settling tanks, sludge drying beds, dosing tanks, sprinkling filters, secondary tank, sludge-pumping station and appurtenances, paid for in lump sums, are fully covered in 22 pages and 4 additional pages cover some special work, some paid for in lump sums and some by unit prices. In addition are the usual General Conditions, and papers pertinent to advertising, bidding, signing the contract and bonds. Inspection indicates that results equal to those obtained under far more extended specifications have been obtained.

The Albany, N. Y., Typhoid Fever Damage Suits

The Appellate Division of the Supreme Court of New York State has unanimously the action of a supreme court jury which in November, 1926, awarded $2,000 to a minor and $1,000 to his father on the claim that the patient contracted typhoid fever from the drinking water of the city.

In April, 1924, Mr. Charles R. Cox, Assistant Sanitarian, Division of Sanitation, State Department of Health, Albany, N. Y., comments in the case as follows in the November Journal of the American Water Works Association.

The water supply of the city of Albany is secured from the Hudson River at a point about 8,000 ft. north of the main portion of the city. An elaborate water purification plant is utilized to treat the heavily polluted Hudson River water. This plant consists of aerators, coagulation basins, rapid sand filters, secondary aerators, slow sand filters and chlorination equipment. The chlorinated water from the clear well flows to a high pressure pumping station about 8,000 ft. south of the filtration plant through a conduit.

The filtration plant is under expert supervision and water of a safe sanitary quality has been discharged into the clear well. The conduit conducting the effluent from this clear well to the high pressure pumping station, however, consists of about 8,000 ft. of steel piping 48 in. in diameter, most of which is covered with concrete. The steel conduit had been in use for over 20 years and the walls had become seriously corroded at points. This conduit is laid for the most part under the bed of the abandoned Erie Canal, which normally contains about 1 ft. of water due to local drainage. In April, 1924, a flood of the Mohawk and Hudson Rivers occurred and the abandoned Erie Canal was flooded to a depth of from 6 to 8 ft. with polluted Mohawk River water.

During April, 1924, there was a sudden increase in the prevalence of typhoid fever in the city of Albany, and during this period the tap water in the city contained increasing numbers of colon bacilli, as determined by bacteriological examination in the State Laboratory.

Suit was brought against the city of Albany by the parent of one of the patients who contracted typhoid fever at this time. A decision in favor of the plaintiff was handed down by the Supreme Court in 1926, which decision was appealed to the Appellate Division of the Supreme Court in May, 1928. The important portions of the opinion of the presiding justice of the Appellate Division are quoted below:

> It is claimed that the disease had its inception in unwholesome water furnished by the city, and this condition arose through the negligence of those in charge of the water system in failing to purify the water delivered to consumers; and that the authorities neglected to give warning, although they had notice that dangers existed. . . .
>
> Beginning on April 7, the water was tested at the state laboratory by and under the supervision of Dr. Wachter, a chemist in the Division of Laboratories and Research of the State Department of Health. These tests were made from the tap which was on the same system as that furnishing water to plaintiff's family. On nearly every day between the 7th and the 23d of April, colon bacilli were found in increasing numbers, indicating some definite source of pollution not eliminated by the filtration. About this time there was a sudden increase in gastro-intestinal diseases in the city. The officials in charge of the water department had notice of the defective condition of the conduit, the sudden pollution of the water, and of the outbreak of diseases traceable to impure water, but the warnings were ignored. It was a time for prompt and decisive action. There were two possible sources of contamination—one by impure water passing the filters into the well; the other by introduction of polluted water into the conduit. The exercise of vigilance would have led to discovery of the dangerous condition, and reasonable diligence would have provided the remedy. It was possible by greater chlorination before the water went into the clear water well, to eliminate all dangerous bacilli which had passed the filter; and there was a chlorination plant at the Quackenbush St. pumping station which would have removed the new pollution occurring in the conduit, but this was not put in use, at least during the first ten days in April. Common prudence would have suggested a notice to citizens that the water had become polluted, and a recommendation that all water intended for human consumption should be boiled. But no preventive measures were taken until an epidemic had broken out. . . .
>
> To insist that the plaintiff must establish that the infection came from the city water by positive proof, would be to require an impossibility. It is sufficient if it is shown by the best evidence available that the bacilli were introduced into his system by means of the city water, so that the jury may by reasonable inference reach a conclusion to that effect. This is not speculation, but a process of logical deduction. . . .
>
> The plaintiff gave proof excluding other sources of infection. The defendant's counsel in argument merely suggests that there are other possible sources, but there was no sufficient proof on its part of their presence or of the probability that such causes intervened to furnish the origin of the plaintiff's disease. The epidemic at this particular time, including such a large number of cases, would under the circumstances shown, indicate a common origin. . . .

Particular attention is called to the next to the last paragraph above, since it is not unusual in cases of this kind for attorneys for the defense to attempt to make the plaintiff furnish positive proof that the infection came from the water, which, as the court justly says, is an impossibility.

Since this outbreak of typhoid fever, great care has been exercised in maintaining 0.20 to 0.25 p.p.m. residual chlorine in the tap water in the city about ¾-mile from the point of application, although this practice has naturally resulted in the delivery of water with a chlorine taste at frequent intervals. The city authorities have installed a booster pumping station at the filtration plant, which places the repaired conduit under a positive pressure at all times, so that any appreciable leakage would be of filtered water outward rather than polluted surface water inward. The water passing through the conduit is again chlorinated at the high pressure pumping station.

The steel conduit is being replaced by cast iron pipe at considerable expense. This pipe line will be used until the new water supply from the Catskill Mountains is completed, which will permit the abandonment of the Hudson River supply, and the use of the cast iron pipe as a main feeder for the northern portion of the city of Albany.

The Function of Aeration in Water Purification

A Paper at 10th Texas Water Works Short School

By N. T. VEACH
Consulting Engineer, Kansas City, Mo.

AERATION has been employed in water works practice since its inception, as is evidenced by the cascades and fountains, commonly found in water systems, both ancient and modern. There is no evidence, however, that the fountains or cascades used previous to the early eighties were installed for any reason other than that of beauty, although it is possible that reduction of odors may have been noticed in some cases.

The use of aeration as an adjunct to water purification in this country dates back to 1883, when its use was investigated by Leeds in connection with water purification studies at Philadelphia, and, since that time, aeration in its many aspects has been studied by numerous investigators. Many technical articles on aeration have been published since 1900, and a study of this subject leaves no doubt of the fact that, while aeration is established as an important aid in water purification, it is not, in any sense, a "cure-all," or a complete treatment for water troubles, and unless used properly, may be an actual detriment to the water.

What Simple Aerators Will Do.—The investigations on aeration have proved beyond a doubt that, with simple aerators:

1. Oxygen may be added to water to the point of saturation.

2. Carbon dioxide may be largely, but not completely, removed.

3. Odors and tastes, when due to gaseous products of organic decomposition, may be removed to some extent, but when due to products of organic decomposition in solution, the effect is negligible.

4. Odors and tastes due to coal tar, phenol, oil refinery and similar wastes, are affected little.

5. Odors and tastes due to overchlorination may be satisfactorily removed.

6. Odors due to hydrogen sulphide are easily eliminated.

7. The actual oxidation of organic matter in solution or suspension is negligible, but some inorganic compounds, notably those of iron and manganese, are largely, but not completely, oxidized.

8. The "aggressiveness" or corrosiveness of some waters, usually "soft" or "peaty" waters, is increased by addition of oxygen, but that of surface water commonly encountered in the Middle West, is not appreciably affected.

9. The economy and effectiveness of treatment with the ordinary coagulants is, with few exceptions, increased.

10. The bacterial content of the water is often reduced appreciably.

When Aeration Should Be Considered.—From the foregoing conclusions it is evident that the water works man must consider aeration when designing or operating a water plant, to treat:

1. Waters which contain iron or manganese held in solution by carbon dioxide.

2. Waters which contain carbon dioxide and which are to be softened, or which, due to their carbon dioxide content, are "aggressive."

3. Waters from algae-laden reservoirs or reservoirs upon which ice forms.

4. Some rivers which are hard to treat with ordinary coagulants, or which, during low water, approach the conditions found in an impounding reservoir.

Several questions which must be answered for each individual case and which, unfortunately, can be answered only in a general way, with plenty of allowance for numerous exceptions, are:

1. How complete is the aeration required?

2. Is aeration economical, in view of the fact that carbon dioxide can be removed by the use of approximately 15 lb. of lime (or an equivalent amount of soda ash), per million gallons of water per part per million of CO_2?

3. At what stage in the treatment-process should the water be aerated?

4. Which of the numerous types of aerators should be used?

Usually, if aeration is needed at all, it should be carried through to an extent which will saturate a water which is originally devoid of oxygen. If carbon-dioxide removal is the object, this extent of aeration will ordinarily leave not more than 5 parts per million in solution when highly-charged waters are treated, and will remove, approximately, 50 per cent when the original amount of carbon dioxide is from 5 to 10 parts per million. Further aeration will, of course, effect a more complete removal, but at a rate so slow that it is out of the question from an economic standpoint.

If removal of odors is the object, this extent of aeration will permit a thorough "sweeping out" of the gases which cause the trouble, and, to obtain further removal of odors, actual oxidation of the organic matter which causes them must ordinarily take place. This will require a period of aeration much longer than that obtainable in the usual type of aerator, and, in addition, the aeration to be effective must take place in the presence of certain "oxidizing" or nitrifying organisms. This is the underlying principle of the "activated-sludge" process of sewage disposal.

The results obtainable by various types of aerators will be discussed below, but, for ordinary waters, an additional head of 8 ft. will be sufficient to provide this amount of aeration.

The economy of aeration can be determined by balancing the cost of the additional head required against the cost of additional lime or soda-ash treatment. If softening or coagulation is to be practiced, as is usually the case, this additional cost of chemicals is all that need be considered.

At Albuquerque, N. Mex., the city water, obtained from wells, has approximately 6 parts per million of carbon dioxide in solution. An iron-removal plant with facilities for feeding lime is to be built. The cost of pumping the water against an additional head of 8 ft. amounts to 83 ct. per million gallons, while the additional cost of lime necessary to remove the 3 parts per million of carbon dioxide which an aerator can be expected to remove is only 45 ct. per million gallons. Generally speaking, an aerator cannot be economically justified for waters which contain less than 10 parts per million of carbon dioxide unless the elimination of odors enters into the problem, in which case aeration is, of course, necessary.

Aerators have been used successfully before and after sedimentation, and, in several recent installations, the effluent from sand filters has been aerated before storage. Ordinary purification-plant design, however, usually precludes aeration at more than one location, and, for the customary water encountered in the central part of the country, the practice of aerating the raw water before further treatment is well established and seemingly satisfactory.

At Moberly, Mo., water is aerated immediately after the addition of chemicals, with rather poor results, due to

the fact that the partially formed floc is broken up by the action of the aerator. Pirnie reports a case in Danville, Va., where a reduction in chemical dose was made possible by aeration for removal of CO_2 immediately after the addition of alum.

The selection of the proper type aerator for use is, of course, a matter to be determined for each case, to fit the local conditions, of head, quality of water and treatment-process.

The aeration devices commonly used in water purification may be divided into general classses as follows:

1. Air-lift pumps.
2. Injection aerators in which air is blown into the water.
3. Gravity aerators in which the water flows out of riser pipes, flows in thin sheets over weirs, cascades, or inclined planes, drips through perforated pans, or percolates through beds of suitable ballast.
4. Fountains, where the water is sprayed into the air through nozzles.

Air-Lift.—Air-lift apparatus for water pumping from deep wells has been in use for years and is well known, but its aerating effect on water has not been given much consideration until fairly recently.

Donaldson, at Memphis, found that air-lift pumping reduced the carbon dioxide in the local well water from 107 to 30 parts per million.

Air-lift equipment coupled with simple riser-pipe inlets to storage basins, at Pittsburg, Kan., has been effective in removing hydrogen suphide odors.

Injection Aerators.—Aerators of the injection type have been used for water in a few instances, but, at the present time, this practice is largely limited to aeration of sewage, with the purpose of continuous aeration at a relatively high rate in the presence of nitrifying organisms, and for a period long enough for actual oxidation of organic matter to take place. This requires from four to six hours, while the ordinary aerator as used in water practice, operates for a period of only one or two seconds.

At Hackensack, N. J., a substantial reduction has been effected by air blown through the stagnant layers of a reservoir by means of a gridiron system of small pipes, and at Essex, Ont., air applied at the rate of 5 cu. ft. per 100 gal. through a single filter plate 12 in. square, increased the dissolved oxygen from 2.0 to 4.5 cc. per liter, reduced the carbon dioxide from 6.6 to 3.9 parts per million and completely removed, approximately, 10 parts per million of hydrogen sulphide. Aeration, in this case, was primarily for the purpose of reducing the necessary rate of chlorine feed, which, due to absorption by hydrogen sulphide, was 40 parts per million in the unaerated water, to 3 parts per million in the aerated water. Aeration, in this instance, effected a net saving of 50 lb. of chlorine per day and presents a rather novel and interesting use for this treatment.

The principal objection to this form of aeration is, of course, the fact that the air blown through the water precludes the use of valuable basin-capacity for coagulation or settling, and the cost of providing additional tanks for this purpose is, usually, out of the question from a standpoint of economy. However, where head is not available, or in cold climates, this type of aerator may be used to advantage.

Gravity Aerators.—Probably most of the aerators now in use are of the gravity type, which general type, as stated above, includes riffle-boards, riser-pipes, cascades, spilling-weirs, coke-beds, etc.

This is probably due, partially, to the relatively low head required and partially due to the fact that, for given capacities, gravity aerators can be constructed at a cost lower than that of other types.

Inclined planes studded with riffle-plates are used at Cambridge, Mass.; Plattsmouth, Nebr.; Norristown, Pa., and several other plants.

At Cambridge, 14 million gallons per day of filter-effluent is treated on riffle-boards which cover 923 sq. ft. and which are set in a slope of 3 ft., horizontal, to 8 ft. vertical.

From 20 to 30 per cent of carbon dioxide is removed by this process, which represents a loading of, approximately, 10 gal. per square foot per minute.

At Portsmouth, Va., four steps each 13 in. high are used, and about 40 per cent of CO_2 is removed.

In tests made at Memphis on the aeration afforded by allowing water to flow evenly over an inclined walkway 10 ft. wide, 28 ft. long, with a drop of 2 ft. in length, 46 per cent of carbon dioxide was removed from water which originally contained 28 parts per million.

At Excelsior Springs, Mo., an aerator of the multiple-pan type has been in use for 12 years. Water enters this aerator through a riser-pipe, which terminates in a steel pan 7 ft. wide, 20 ft. long and 4 in. deep. From the sides of this pan the water spills successively into two pans 4 ft. wide, thence into four pans 2 ft. wide and thence into 8 pans each 1 ft. wide. The four tiers of pans are set 1 ft. 9 in. apart, vertically, and the total drop from the upper pan to the floor of the collector is 7 ft. 6 in. The total area of the pans is 620 sq. ft. and the total weir length is 600 lin. ft. When operated at a rate of 512 gal. per minute, approximately 68 per cent of the CO_2 was removed from water with an original content of 85 parts per million.

Multiple-pan aerators of this type are in successful use at Topeka, Kan.; Lawrence, Kan., and a number of other places, and recently, at the suggestion of the Kansas Board of Health, flat slabs of lumber or concrete have been used in place of the pans, at a considerable saving in cost, and no decrease in efficiency.

An aerator of the multiple-pan type, but with perforations in the pan bottom, was constructed at Superior, Wis., in 1901, and gave excellent results, as did one of a similar plan built at Winchester, Ky., about the same time. Most of the early aerators used as an aid to water purification were installed for the purpose of iron removal and a common expedient was to allow the water to percolate through beds of coke coal or other ballast.

Carbon dioxide is removed to some extent by this process, since the water flows in thin films over the ballast and the oxides of iron on the ballast itself acts as a catalyzer in the oxidation of the iron. This process is still in use in many plants, but generally, in connection with pre-aerators, settling basins and filters, and experience has shown that, for complete removal of iron and manganese, lime or soda-ash treatment must be included in the process.

Fountain Aerators.—Aerators which employ jets or sprays seem to be more generally used now than heretofore, probably due largely to the development in recent years of nozzles, which will operate efficiently at low heads. Satisfactory results are obtained at Charleston, S. C., with a head of 4.5 ft., and at Sacramento, Calif., a "floating" type of nozzle which will operate at still lower heads has been developed. Ordinary nozzles require heads of from 15 ft. upward.

Another reason, and a potent one, for the selection of the fountain-type of aerators, is the opportunity offered for "dressing up" the plant. As Mahlie very truthfully says in his article on "Aeration in Water Purification," "a ½-in. pipe spraying water in the air over a pool, apparently satisfies the general public more than a 6-in. line discharging sterilized filtered water beneath the surface."

Where head is available for fair-sized water streams, extremely sightly arrangement of nozzles can be made, as evidenced by recent installations at Denver, Colo.; Oakland, Calif., and elsewhere.

Exclusive of the question of head, spray nozzles offer the most efficient method of aeration, and experience indicates that the nozzles which throw a whirling, fine spray are the most efficient.

Donaldson's experiments at Memphis provide an excellent yardstick for determining the amount of aeration obtainable by different types of aerators.

He found that water which contained 28 parts per million of carbon dioxide, lost, approximately, 14 parts per million, or 50 per cent, on being discharged from a 2-in. riser-pipe and falling 5 ft., and that this rate was fairly constant while the flow varied from 40 to 110 gal. per minute. When an 18-in. cir-

cular splash table was placed 18 in. below the top of the riser-pipe 18 ppm. was removed at a discharge of 95 gal. per minute and 12 ppm. was removed when the discharge was 40 gal. per minute. When a pan 18 in. square, perforated with 211 holes, was placed 5 ft. above the receiving basin, a removal of from 14 to 17 parts per million of CO_2 was effected. Three 12-in. coke beds set with 12-in. openings between them, and a total vertical fall of 6 ft., effected a reduction of 21 parts per million at a loading of 70 gal. per square foot per minute, and of 24 parts per million when the loading was reduced to 10 gal. per square foot per minute.

Spray-nozzle experiments on the same water showed that it is possible to reduce the residual carbon dioxide to two or three parts per million with discharges of from 80 to 100 gal. per minute, and that they were more efficient than aerators of the gravity type.

It is interesting to note that in the case of Memphis, aerators of the gravity type and consisting of multiple pans of coke, were selected for construction, even though a greater efficiency was shown by the sprays.

Summary.—Results of tests on aerators of different types, operating under different heads on different waters, vary so greatly that no general conclusion can be made as to the effect any particular type of aerator will have on a given water, and one is forced to the conclusion that, for safety, design should be based on actual tests made under operating conditions on the water to be treated.

The efficiency of aeration in iron and manganese removal, odor removal, treatment for aggressiveness or corrosiveness, and as an aid to coagulation, is established, and like filtration or carbonation, aeration is a valuable tool, to be used in the proper place in the water-treatment plant.

Methods of Financing Extensions in Large Cities

A report compiled by the Municipal Reference Division of the Seattle Public Library for the Water Department of Seattle, Wash., shows that three methods of financing water main extensions were in use in the 33 cities of over 200,000 population in this country. The following extract from the report gives the information on these methods:

Assessment.—The costs of extensions are assessed against abutting property, in whole or in part, in the following cities:

Cincinnati. $1.50 to $2.50 per front foot according to pavement. This is estimated as one-half actual cost. Property on undedicated streets must pay all costs.

Cleveland. $2 per front foot, maximum charge. Corner lot assessed on one side only.

Columbus. Cost of 8-in. main or less with deductions for frontage supplied with water within 30 days (1924 information).

Detroit. 75 ct. per front foot. Corner lot assessed on one side only.

Los Angeles. District assessment bonds, or 80 ct. per front foot. If property is in excess of 200 ft. a deposit of 80 ct. per front foot on each side of street beyond 200 ft. is required. Deposit returned when new services are installed for other property fronting the mains, or at end of 5 years.

Milwaukee. Cost of 6-in. main. One-third of total frontage of corner lots exempt when main is laid on long side.

Minneapolis. One-half cost of 6-in. main. Corner lot assessed for long side; short side exempt up to 66 ft.

Omaha. Cost of 6-in. main. Two-thirds of side of corner lot exempt.

Philadelphia. $2 per front foot. One-third of one side of corner lot exempt, not to exceed 50 ft.

St. Paul. $1 per front foot payable in 10 yearly installments without interest. Short side of corner lot assessed up to 125 ft.

Seattle. Cost of not more than 8-in. main in residence district. Maximum charge $2.25 per front foot. Corner lots assessed for side on which building faces. Business districts assessed for cost of main necessary. Corner lots assessed on both sides.

Washington. $2 per front foot. 100 ft. exemption on corner lot.

Water Funds.—Cost of extensions are paid from the water funds in the following cities: Boston, Buffalo, Denver, Jersey City, Indianapolis (private company), Kansas City, Mo., New York, Oakland (private company), St. Louis and Toledo. (Information is of 1924 for Boston, Buffalo, Denver, Jersey City and Toledo.)

In the following cities costs are met from water funds with certain exceptions or provisions:

Akron. Assessment basis is used only in allotments where allotment company assumes and distributes the entire cost.

Baltimore. A deposit of $1.50 per linear foot is required but this is refunded to the extent of $100 per lot if a house is built within 10 years. Property owners must pay any extra costs due to street not being within 6 in. of established grade.

Chicago. An assessment on the cost of a 6-in., 8-in. or 12-in. main is made, but 90 per cent of the assessment is returned when a survey shows a revenue of 10 ct. per linear foot. This is generally within 5 years.

Louisville. If revenue does not justify the extension, property is assessed but a refund is made if revenue is sufficient within 5 years.

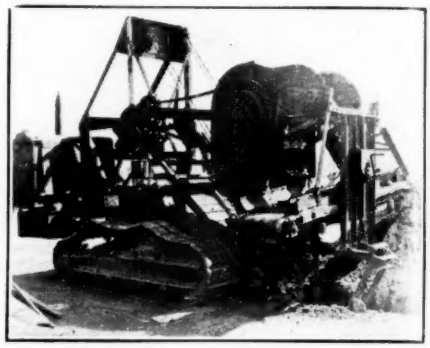
Portland. Six per cent revenue must be guaranteed.

Providence. Seven per cent revenue must be guaranteed for unaccepted streets (1924 information).

Ditching Machine Economical with Limited Trenching Program

The use of a light ditcher is often real ecomony for the community having as little as 12,000 lin. ft. of ditching to do in the course of the year. An interesting case has been recently reported that bears out this assertion.

During 1927, the City of Kalamazoo, Mich., operating a Barber-Greene vertical boom ditcher, dug 12,128 lin. ft. trench for 6 in., 8 in., and 24 in. water mains, reported the following cost data,



Light Ditcher Used in Kalamazoo, Cost Data on Which Are Given on This Page

as compared with costs of similar work by other methods done during the previous year:

	Per lin. ft., 6 in.	Per lin. ft., 8 in.
1926	$1.64	$2.73
1927	1.47	2.14

The actual costs of operating the machine for that year, showing the total and per lineal foot costs as given out by Earle E. Norman, Department of Public Utilities, were found to be as follows:

	Cost for 12,128 lin ft.	Cost per lin. ft.
Gasoline	$ 48.18	$0.00398
Oil	7.19	.000594
Grease	9.14	.000754
Repairs	119.49	.00994
Repairs, labor	64.38	.00538
Total operating cost	$ 248.38	$0.02065
Depreciation	831.64	.068
Total	$1,080.02	$0.08865

To these costs must be added moving costs of $5.28 per mile and a rental charge of 10 ct. per lin. ft. for the use of the machine, which charges were made in this instance.

While comparative costs are not available on the 24 in. main, the department has stated that while the estimate on a project for laying 24 in. main using other methods was $12,500, that the job was actually done in 1927 with this type of ditcher for a labor cost of $9,065.73 and a machine cost of $342.28, giving a total cost without material of $9,408.01, thus making a total saving of just over $3,000. At least $2,000 of this saving, it was stated, could be directly ascribed to the use of the machine.

Design Data For Open Gravity Type Rapid Sand Filters

Elementary Features Described at Texas Water Works School

By A. W. LIVINGSTON

E. W. Bacharach & Co., Consulting Engineers, Kansas City, Mo.

The writer will restrict his paper to design data pertaining only to the filter unit itself and more specifically to the open gravity type of rapid sand filter.

The original rapid sand filter unit was built circular in form, constructed out of wood or steel. Nowadays it is customary to construct such filters out of concrete and to build them rectangular in form. Some of the advantages gained by this are durability, elimination of waste space and the use of the concrete walls of the filters as a support for the building covering them. The rectangular shaped filter has many other advantages, chief among which is the fact that a more efficient underdrain and wash water distributing system can be adapted to it.

Filter Capacity.—For average conditions the capacity of a filter to be used for domestic supply is based upon a rate of flow of 2 gal. per minute for every square foot of sand bed area. In other words, if a certain filter is to have an output of 300 g.p.m., the area of the sand bed should be 150 sq. ft. If the filter is to be used for clarifying water, without regard to the removal of bacteria, its rate may be increased to three and sometimes as high as 4 gal. per minute per square foot of sand area. If, on the other hand, the filter must be designed to purify a highly contaminated water, or if the filter is to be used in connection with an existing mixing chamber, and settling basin yielding low efficiency, it would be advisable to increase the sand bed area so that the filter could be operated at a slower rate than the standard rate of 2 gal. per square foot of sand surface per minute.

After knowing the total capacity of filtered water in gallons per minute required to meet a particular case, it is only necessary to divide this sum by the rate at which the filters are to be operated in order to determine the total filter sand bed area. For example, if the plant is to have normal capacity of 700 g.p.m., and is to be operated at a rate of 2 gal. per square foot of filter sand surface per minute, the total sand area would be 350 ft.

Number of Filter Units.—The next step is to decide the number of filter units that the toal capacity is to be divided into. This is determined by size of plant, possibility for future extension, ground space available, economy in first cost, operating expenses, etc. Unless the filters are designed for an ample reserve capacity above the maximum requirement, it is advisable to build them in comparatively small units, so that when one or more are out of service for washing or repairs, the remainder may still be able to meet filtered water demand. On the other hand, if there are indications that the consumption of filtered water may rapidly increase after installation of the filter plant, it would be more economical to use larger filter units and have their total capacity considerably in excess of present requirements.

There is no fixed rule for determining the correct proportion between length and width of a filter unit. This depends upon capacity of filter, type of underdrain system to be used and other factors. As a general rule, the length of a filter should be from 10 per cent to 30 per cent greater than its width. This shortens the length of pipe gallery and operating floor, thereby reducing cost of pipe and the distance that the operator has to cover in order to manipulate the filter valves and devices. Moreover, wash water troughs and strainer systems can usually be better adapted to the long and narrow unit than to the short and wide filter or the absolutely square unit. For example, a filter unit having a capacity of 500,000 gal. per 24 hours is very frequently required, and unless adverse conditions obtain such a unit is usually built 15 ft. long by 12 ft. wide. As a result, patterns for the underdrain systems and wash water troughs have been made by all equipment manufacturers for this standard size. If the same sand area, namely, 180 sq. ft., were made up by designing a filter 20 ft. long by 9 ft. wide, it would make it difficult to arrange strainer system and wash trough for uniform distribution and would crowd the valves, valve stands, controller and other appurtenances.

Depth of Filter.—Most engineers require a total depth of sand and gravel of about 4 ft. In order to prevent the carrying away of the filter sand, the top of the wash troughs are placed about 2 ft. above the top of the filtering material or approximately 6 ft. above the bottom of the filter. As the level of the water on top of the filter varies to some extent in most plants, space should be provided above the wash troughs to take care of this variation. Usually about 2 ft. is allowed for this so that the average filter has a total inside depth of about 8 ft. This depth may be increased or diminished within certain limits if necessary, but these limits are determined by local conditions as well as economy of operation. For example, the vertical distance between the water level on the filter and the outlet of the filter which constitutes the head under which it is being operated should be about ten or twelve feet in order to get the maximum output between washings of the filter.

If local conditions make it impossible to carry the filter effluent pipe some distance below the bottom of the filter, the filter would be built deeper than the customary 8 ft. and still give a total operating head within the limits just mentioned. On the other hand, if conditions make it necessary, the depth of the filter could be reduced by cutting down the depth of filter material, lowering the top of the wash troughs and not allowing as much space above the wash troughs for variation of water level. In any event, however, it is very poor practice, except where absolutely necessary, to reduce the inside depth of the filter more than a few inches or at most a foot below the generally accepted minimum depth of 8 ft.

Underdrain System.—The underdrain system of a filter was originally designed to accomplish three purposes, first, collect the filtered water from under the gravel bed; second, distribute the wash water; third, prevent the passage of sand from the filter. Nowadays, most practical filter engineers realize that a properly graded gravel bed can be relied upon even more than the strainer system to accomplish these results.

Although there have been many types of strainer systems developed in recent years, the fact remains that the older form of strainer system constructed of perforated pipe laterals and modified to meet any particular requirements is still more popular than any of the newer types. This, as above stated, is principally due to the fact that improvements in the design of the gravel bed have robbed the strainer system of some of the principal functions. As far as we see it, the merits of one form of underdrain system over another should be determined chiefly by minimum friction loss, during ability, economy in first cost and maintenance, easy access for cleaning or repairing.

Layer No.	Passing a Screen Having Circular Openings of the Following Diameter	Retained on Screen Having Circular Openings of Following Diameter	Depth of Gravel Layers
1 (on bottom)	2½ in.	1½ in.	4 in.
2	1½ in.	1 in.	4 in.
3	1 in.	½ in.	4 in.
4	½ in.	¼ in.	3 in.
5 (on top)	¼ in.	1/12 in.	3 in.
Total depth			18 in.

Thickness of Gravel Bed.—From what has just been said, it follows that the gravel bed placed over the underdrain system is a most important element in the filter. By using a layer of coarse gravel immediately over the strainer system and placing upon this layer successive layers of smaller sized gravel tapering the bed from coarse at the bottom to fine at the top and by making the total depth of gravel between 18 in. and 24 in., it is possible to prevent the loss of sand and at the same time obtain uniform collection of filtered water and a correct distribution of wash water.

Sanitary engineers working independently of each other have gradually developed specifications for gravel bed that are very similar. In one of our largest filter installations of recent date, the specifications call for the following gravel sizes and depth of each layer, and these same specifications with slight modifications are almost generally used nowadays.

The Sand Bed.—The quality of the water to be filtered determines to some extent the size of sand grains and depth of sand bed that would be most effective. The largest sand grains that will obtain satisfactory filtration are apparently the best to use as they offer less resistance to the flow of water during either the filtering or washing process. For all practical purposes, a filter sand having an effective size of between 0.40 and 0.50 mm. with a uniformity coefficient not in excess of 1.7 is suitable, provided, of course, that it has a high specific gravity and contains a minimum amount of perishable substances, such as lime, etc.

The depth of sand bed most commonly used is 30 in., although some designers, realizing that only the first few inches of sand on the surface of the bed do practically all of the filtration, have reduced this depth to in some cases 27 in. and even below.

Assuming that provisions have been made to satisfactorily coagulate and settle the water before applying it to the filter, there seems to be no real foundation for specifications calling for sand much finer than 0.40 mm., as small sand grains increase loss of head through the filter, necessitating more frequent washing without apparently increasing the efficiency of filtration. Naturally the more uniform the sand grains run in size the less likelihood there will be of unequally distributing it during the washing process.

There is still some difference in opinion as to whether rounded sand grains are preferable to sharp grains, but as far as we know, no conclusive evidence has been presented to solve the problem definitely one way or the other. In any event, if sharp grains of sand are used, they will in time become more or less rounded by the washing process.

Wash Water Provisions.—Wash water troughs are designed of sufficient size to discharge the wash water freely without filling up under maximum wash water rate of flow. The top edges of each trough should be absolutely level and the top edges of all troughs in the filter should be in the same horizontal plane with each other. The troughs must be placed at just the proper height above the sand bed. If too high, much of the heavy sediment will fail to pass into the troughs, and after the washing process will settle back on top of the sand. If too low, sand will be carried over into the troughs.

As a general rule, the top edges of the wash troughs should be about 2 ft. higher than the surface of the sand bed, although naturally this distance is controlled by the rate of wash water that is to be used. The troughs must be placed close enough to each other so that the horizontal travel of the water will not be too great. If the troughs are too far apart, much of the dirt which is carried with the water will settle out before it reaches the troughs. If the troughs are too close to each other, there is a likelihood of carrying sand into them. A common practice is to place the troughs parallel to each other and about three and a half feet apart.

Effluent Rate Controller.—In order for a filter to maintain a uniformly high efficiency, it is necessary that the rate of flow through it be kept within the limits of its capacity. It is furthermore imperative that no sudden change in the rate of flow should occur, as this might cause a serious disturbance in the sand bed. To obtain these results, an effluent rate controller is placed in each filter outlet pipe. The merits of one type of controller over another are determined by many considerations, some of which are as follows: Its ability to maintain with a minimum of error any rate for which it has been set, irrespective of the changes that take place in pressure within the filter. Facility for regulation of the controller for any desired rate without undue loss of time or trouble. Its gradual responses to such changes in rate without sudden shocks. Simplicity of design and minimum loss of head required for its operation. Durability, economy of maintenance and repair and accessibility to moving parts.

While the filter is in operation the impurities removed from the water gradually accumulate and build up a resistance to the passage of water through the filter to such an extent that finally the filter will fail to yield its normal output. Most efficient results are obtained if the filter is washed just before the drop in output occurs. Naturally, if the filter is washed before this time, there is a needless waste of wash-water. If filter is allowed to operate under decreased capacity, it not only interferes with the requirements for filtered water, but there is also a possibility of compacting the sand bed to an extent that would require excessive washing with consequent disturbance of the filter materials. It is therefore necessary to provide a device known as a loss of head gauge, which indicates to the filter operator the proper time for washing the filter.

Methods of Control.—The operating values of a filter may be controlled manually, hydraulically or electrically. Electrically operated valves fulfill all of the requirements of the hydraulic valves insofar as ease of operation and labor saving are concerned.

If first cost would be entirely disregarded, there would be no reason for using hand operated valves as they entail loss of time and extra effort. Besides, the valve stands used to manipulate them are of necessity so placed as to waste space and detract from the appearance of the plant. When the valves are hydraulically operated, they are controlled by an attractive looking table made out of marble or other material and concentrate the efforts of the filter operator and make it less possible for him to manipulate the incorrect valve. In a large filter plant it is imperative to use hydraulically operated filter valves first because the valves are large and would be unwieldly to manipulate by hand, second, because they save labor and effort. Some of the smaller plants do not absolutely require the use of hydraulically operated valves, and on account of their greater first cost depend upon manual control. As stated above, however, it would be preferable to have valves hydraulically operated even in small filter plants, but limited funds frequently prohibit this.

There are many other useful devices used in connection with a rapid sand filter, such as gauges for indicating or recording the rate of flow of water through the filter, appliances for obtaining samples of water from different sources in the filter plant, wash water rate controller for maintaining a uniform rate of wash water to the filter, etc. These, however, have to do more with the operation of an entire filtration plant and as the scope of this

paper is limited to design data pertaining only to the filter unit itself, we shall not attempt to go beyond this limitation.

In order to be brief, the writer has in some instances made bare statements without attempting to prove them, and has by no means covered all the important points of design of a rapid sand filter, but only what he considereed the elementary features.

Tracing Underground Waters

How Uranine Dye Was Used to Locate Outlet of Creek

By A. W. CROUCH
Resident Engineer, The Tennessee Power Co., McMinnville, Tenn.

IN connection with some recent work at the Great Falls Plant, located near Rock Island, Tennessee, it was necessary to locate the outlet of a small sinking creek lying some eight miles north-east of the plant. After a study of the whole situation and some ineffective tests with potassium permanganate several tests were made using uranine dye. This dye was found very effective in tracing underground water.

General Conditions.—Sinking Creek emerges from the ground at the foot of a low mountain ridge about two miles north of the town of Doyle. It flows on the surface of ground in a south-easterly direction for about ¾ mile and sinks in an irregular row of small holes along the foot of a limestone bluff.

The rock formation in this section of the country consists of Bangor limestone with a dip to the East of 30 ft. or less to the mile. The beds of rock vary in thickness from a few inches to many feet with numerous clay seams and clay pockets scattered throughout the area. Caves, underground streams, sink holes and springs are very common over the entire section. The Calfkiller River, flowing south, is about three miles east of the sink hole in which the dye was placed while the Caney Fork River, flowing west, is about five miles south of the sink hole. There are many springs of various sizes along the banks of both rivers.

A rather definite line of sink holes and caves extends from the point where Sinking Creek disappears to a point on Calfkiller River known as Hensley's Spring. By air course it is 2½ miles away. Taking this fact into consideration together with the fact that the rock dips to the east it seemed probable that the Hensley Spring was the outlet for Sinking Creek although later developments proved that this was not the case.

What Uranine Dye Is.—Uranine dye is a coal tar product, being one of the numerous compounds derived from resorcin. The latter is made by fusing gum resins with caustic potash. Uranine is a reddish brown powder, which when dissolved in water, turns the water green. It is particularly adapted for coloring large volumes of water as it is easy to handle, readily soluble, safe and can be detected when present in very small quantities. From some rough test made in the laboratory it was easily seen when present one part in five million. It can be detected when present one part in ten million. When present in small quantities it is most easily seen by placing some of the water with the dye in it in a test tube and holding it so that the light strikes the side of the tube.

All the tests were made during the month of October, 1927. The stream flow in Sinking Creek at the point where it sinks was 1.4 cu. ft. per second at the time of the tests. No appreciable amount of rain had fallen for several weeks. As stated above it was expected that the outlet would be found along the Calfkiller River and it seemed reasonable to suppose that it would not take over one or two days to get results.

How the Tests Were Made.—One and one-half pounds of dye was dissolved in water in large tubs and dumped into the creek at the sink holes in the first test. At the end of the second day no trace of the dye had been found at any of the springs along either river. Another pound of dye was then poured directly into the sink holes without first dissolving it in water.

On the morning of the fifth day after the first batch had been put in Sinking Creek green water was found at the Johnson Spring, on Calfkiller River, located three and one-half miles southeast of the point where Sinking Creek disappears. The stream flow at this spring was 2.7 cu. ft. per second. By night-fall all trace of the Uranine had passed. Two days later or five days after the second batch of dye had been put in the creek green water was again noticed at the Johnson Spring. As in the first case all the colored water had passed by dark. Judging by the strength of the color in the early morning it is probable that the Uranine was first present at the Johnson Spring some time during the night preceding. This spring is 71 ft. below the level at which Sinking Creek disappears.

A third test was made two weeks after the first two under similar weather and stream flow conditions. In this test a glass jar was placed in the middle of the stream 15 ft. above the sink holes. At the start of the test one ounce of Uranine was dissolved in water and poured directly into the creek. A continuous stream of water containing the dye was then discharged into the stream from the glass jar through a glass siphon at the rate of one ounce per hour dissolved in 2 or 3 gal. of water. Every half hour an extra heavy dose was poured in the creek. After continuing in this way for 4½ hours another ounce of Uranine was poured directly into the creek. A total of eight ounces of Uranine were used in this test. The dye was well mixed with the creek water before it sank to insure a more uniform distribution of the color. It was thought that all the small sink holes might not discharge into the same channel underground.

Colored Water Appears.—On the morning of the fifth day after the dye had been put in Sinking Creek green water appeared at the Johnson Spring on Calfkiller River. The color was the brightest on the afternoon of that day and could be seen up until late in the afternoon of the following day. Colored water was also found in a well at Onward 4½ miles south-south-west of the sink holes. This well is fed by an underground stream, the bed of which is about 6 ft. lower than the place where the Uranine was introduced. On the sixth day the water from Reno spring, five miles South of the sink holes and on the banks of Caney Fork River, was green up until about 11 o'clock. This spring had a discharge of about 1 cu. ft. per second and is 87 ft. lower than the sink holes where the dye was introduced. It has been reported but never verified that green water was also seen at a small spring one mile West of Reno.

Preliminary investigations indicated that the outlet of Sinking Creek would be found along the Calfkiller River. The outlet at Johnson's spring was in line with this reasoning. The outlet at Reno was a surprise. It is evident that a study of the rock formation and general topography of the country will prove helpful in locating the probable direction that an underground stream will take but such a study should not be relied on entirely. Close watch should be maintained at all springs in the neighborhood.

Measurements of the stream flow should be made at both the point where the stream sinks and at possible outlets in order that proper quantities of Uranine can be put in the water. Allowances should be made for the many uncertainties that are sure to be encountered.

Conclusions Regarding Use of Dye.—It appears to be advantageous to put the Uranine in the stream to be traced in small quantities over a long period rather than to dump the whole batch of dye in at one time. The advantage lies not merely in the fact that the color is retained in the water longer but that it gives the observer time to get from one spring to another throughout the territory before the effect of the dye has passed.

Acknowledgment.—The foregoing is taken from a paper presented by the author at the Third Annual Meeting of the Kentucky-Tennessee Section of the American Water Works Association, held at Louisville, Ky.

Automatic Traffic Control Signals for Boston

PLANS and specifications have been completed by John F. Hurley, Traffic Engineer, Traffic Engineering Division of Boston, Mass., for the first unit of automatic traffic signals for the downtown section of the city.

The accompanying plan shows the area to be controlled under present plans. This is known as Unit No. 1. This plan provides for automatic lights on Washington St., from Broadway to Haymarket Sq.; on Tremont St., from Broadway through Scollay Sq., Bowdoin Sq. and Cambridge St. to Temple and Staniford Sts.; on Boylston St., from Arlington St., through Park Sq. to Tremont St.; on Park St.; on Beacon St., from Park St. to Tremont St.; on Summer St., from Arch St. to Washington St.; and provides for the regulation of traffic flow on the connecting streets between Washington St. and Tremont St., from Broadway to Court St.

A comprehensive automatic control system for the entire downtown district, northeast of and including Massachusetts Ave. is the ultimate plan. Unit No. 1 is the first link in this chain of signals and is so designed that future installations may be added and may be operated through the same cables without overloading them.

Central Control.—The traffic flow will be regulated by a central control device located at City Hall. This central timing device will be designed to accommodate all future interconnected installations in the downtown area.

Progressive control signals will be installed, so called, because they are timed to permit a continuous movement of traffic at a predetermined speed. For example, this scheduled timing, it is expected, will make it possible for any driver once in step with the traffic signals on Washington street, to move northerly through Washington St., Adams Sq. and Haymarket Sq. under normal traffic conditions, with no steps at intersections, provided a speed of approximately 15 miles per hour is maintained. Both the speeder and the laggard will be penalized at the next control intersection if, in any block, he exceeds or falls below the set schedule. This detailed timing plan gives each cross street an adequate opportunity to move its vehicular traffic and especially provides for more frequent opportunities for pedestrian crossing. Under the recommended timing the maximum wait of a pedestrian for a clear opportunity to cross Washington St. will be 40 seconds, which is a material reduction of present practice.

15 Mile Speed.—By actual test runs made, the average vehicular speed on Washington St., between Broadway and Haymarket Sq., is less than seven miles per hour. Under the proposed timing method an average speed of 15 miles an hour can be obtained.

While the speed has been fixed at approximately 15 miles an hour in the downtown area, this speed may be varied from the central control station as conditions will require. It is customary to reduce the speed during morning and evening rush hours and during periods of rain, snow or slippery conditions.

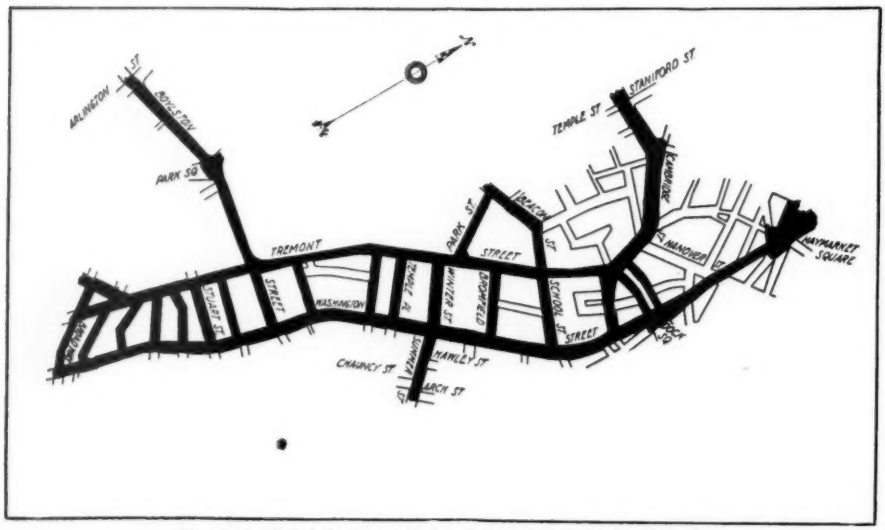
Traffic Light Mounting.—All traffic lights will be mounted on posts on the far right corner where practical. Where a far side mounting cannot give adequate visibility, an alternate or auxiliary signal will be mounted at or near the point where vehicles are required to stop.

The control system is so designed that the lights at any one intersection may be turned off at that intersection, during an emergency, without affecting the operation of the balance of the system. When shut off in this manner the mechanism continues in operation so that when the lights are again turned on they will be in step with the rest of the system. The entire circuit can be shut down at the central control station.

Present plans call for delivery of the equipment in April. It is expected by that time most of the cable construction work will be completed so that installation of the lights may start immediately after delivery. Most of this installation work must be done at night to avoid traffic congestion. Approximately three months will be required for the completion of the installation.

While the installation of Unit No. 1 is in progress, plans will be in progress for Unit No. 2, along Massachusetts Ave.; Unit No. 3, along Summer St., Washington St. North and Cambridge St. extension; Unit No. 4, along Commonwealth Ave. and approximately 25 isolated intersections in the outlying districts.

A traffic engineering division has been established to carry on this work and to conduct scientific engineering studies relating to traffic movement, congestion and accidents throughout the city. Dr. Miller McClintock of the Erskine Bureau for Street Traffic Research has been retained as consultant to work with this new division.



Streets Included in First Unit of Automatic Traffic Signals

New Type of Airport Floodlight

At the International Aeronautical Exposition and Conference at Chicago and Washington the General Electric Company introduced a new type of airport floodlight. The new airport floodlight, designed by C. A. B. Halvorson, designing engineer of the lighting department at Lynn, Mass., contains 14 high-power incandescent lamps, giving a total of approximately three million beam candlepower. The lamps are arranged in a row in front of six cylindrical mirrors that spread the light over the field without permitting it to rise high enough to interfere with the vision of pilots landing directly into the beam of the powerful floodlight. At a distance of a mile from the floodlight there is stated to be sufficient illumination so that a newspaper can be read; and at 2,500 ft., the average maximum airport distance, the illumination is said to be sufficient so that landing pilots can quickly and accurately determine the nature of the landing surface. The plane-parabolic mirrors give the light a spread of 160 degrees horizontally and only three degrees vertically; but, since the reflectors can be adjusted, it is an easy matter to keep all of the light below the line of vision of pilots. Among the advantages claimed for the new design are that a uniform distribution of light is obtained, and a higher intensity of illumination per kilowatt of input is secured.

Importance of Proper Accounting Systems for Municipal Water Works

Important Phases in Accounting That Should Be Considered

By THOMAS S. DURHAM
Division of Accounts, Washington Suburban Sanitary District, Hyattsville, Md.

There is no problem in municipal operations more important than the adoption of a thorough system of accounts through which a full and comprehensive report of the municipality's financial condition may be determined at any time. Everybody knows and will readily acknowledge that it is impossible to guess at the cost of any operation and use this guess as a basis for accurate accounting records. A record that is not true is practically no record at all. Why do we have to keep records? I shall answer that by asking why you keep an account of your personal bankroll? You keep it because it measures your progress and clearly defines your limitations.

In connection with the foregoing I wish to ask three pertinent questions.

1. Do you keep your accounting records so that at any time you can ascertain the true cost of your water system?

2. Have you absolute proof that the municipal organization, for which you are directly responsible, is managed economically?

3. Do your cost accounting records reflect the proper credit to which your administration may be entitled?

I shall not ask you to answer these questions nor shall I go into a detailed description of an accounting system, as the time allotted will not permit, but shall try to illustrate briefly some of the important phases that are necessary to become familiar with, in order to operate and judge results in water works accounting systems.

Need for Uniform Classification.—In the first place a mere recording of transactions, without looking towards an ultimate purpose, cannot give adequate information for financial guidance. In the second place maximum results cannot be obtained unless similar information is kept by a number of allied concerns. If a uniform classification of accounts were adopted by all municipalities in this state, and the combined result studied, each municipality would receive information that could be used to materially reduce nearly all phases of operating cost. We have to know how to use these data after they are compiled. We shall take, therefore, the most important of financial statements, the balance sheet, and see what it is and why we use it.

The balance sheet of a business is like a photograph of a construction project. The photograph well tell you the exact condition of the job at the particular moment it is taken. A succession of balance sheets is a series of photographs showing your financial progress. It shows your assets and liabilities classified in such a way that it is easy to jurge the condition of your business. A glance at the debts that are due or nearly due might reveal that there will not be enough cash in the treasury to pay them. This will be your clue to get busy and immediately provide for more cash before the embarrassing situation actually confronts you. This comparison also indicates the solvency ratio.

Comparative Balance Sheet.—The comparison of each asset or liability, showing the net increase or decrease for the current period, is readily made. This affords information concerning the degree of progress. This is made particularly easy where the comparative balance sheet is used, because the totals at the beginning of the current period are listed alongside of the totals for the current period. In this way the net increase or decrease in each item is shown. The difference between the depreciation reserves and fixed assets will show the present worth of these assets. Deduct from this the fixed indebtedness and you have the present worth of your entire system. By comparing the fixed assets with the fixed liabilities the stability ratio is obtained. In fact, any number of ratios showing both financial and operating results can be made. The possibilities of use to which the balance sheet may be put are too many to discuss exhaustively but remember that the person who does not study his balance sheet is like the person who does not count his money.

Handling Bond Issues.—Each municipality has to depend largely upon its borrowing power to raise any sizeable amount of money. The most general method of doing this is by bond issue. The type of bond issued frequently for water system construction is the sinking fund bond, but there are cases where serial or other types of bonds are used. Regardless of whether the sinking fund or another type of bond is issued there is one point that needs to be stressed particularly. This is the extreme importance of formulating some definite plan for paying the interest on and retiring the bonds at maturity. We will try to see what happens when this is not done. The town of X issued bonds to install water supply and sewerage systems, no definite provision being made to set aside certain sums of money periodically to be applied to the liquidation of these obligations. The assessment may have been high enough to have amply taken care of this need, but the income was used for plant expansion and other expenses seeming more necessary at the time. The time is at hand when the bonds must be redeemed. There is only one step to be taken and that is to re-finance by another bond issue.

It is immediately known that the town of X is in financial difficulties. The market value of its bonds drops and instead of receiving a premium the town has to accept a large discount, which adds another heavy item to the debt. The town might even experience great difficulty in finding a market for its bonds. You can plainly see that it is an unwise step to allow bonds to become due without having provided for their retirement. At best there is confusion and embarrassment for each person that is in any way responsible for such a condition. Refinancing always tends to bring financial soundness into question and affects greatly the possibility of future expansion.

The foregoing is not imaginary as it has actually happened a number of times in this state. The Washington Suburban Sanitary District took over the water system of one town that would have faced re-financing in a comparatively short period but had made absolutely no provision to care for the situation.

Taking Care of Depreciation.—We are all interested in depreciation because it vitally concerns every utility. We have to know something about it to make rates, levy assessments and fix valuations. I dare say that no other subject in public utilities has been more discussed and still is so vague. It is absolutely necessary to provide in some way to take care of depreciation. Otherwise, at the end of the service life of any material asset we would be left with only an empty bag to hold. I am not prepared to say whether cognizance should be taken of actual or theoretical depreciation, but it would seem from observation that the theoretical straight line method will very nearly serve in the ordinary case. Even in this method there are certain factors to be borne in mind, such as inadequacy, obsolescence, growths in water mains, electrolysis

and molecular changes, that will cause a revision of rates.

In the accounting for depreciable assets a plant ledger should be used. The plant ledger is a subsidiary record showing in detail the assets that are carried in one account in the general ledger. In this way all related assets can be kept together with a complete history of each item. This makes possible the knowledge concerning the individual service life of each asset and provides maximum ease in figuring depreciation or the adjustment of rates. Depreciation should be considered in any financial report and the proper reserves shown. The actual taking of a reserve provides a security against the lessening of invested capital. It has to be built up from operating funds as any other cost of the plant would be taken care of. The presence of depreciation reserves indicates conservative and sound managerial policies.

Cost Accounting Not Complicated.—Many people get the impression that cost accounting has some very mysterious qualities, but I assure you that it is not true. It is nothing more than the method of searching out and recording all costs that go to produce a unit of any product. The same principles must be applied to cost accounting as are used in general accounting. The purpose of cost accounting is to render easy comparison of unit costs and make it possible to exercise greater efficiency and economy in extending and operating your system. For example, suppose the expense of installing 6-in. water lines was $2.30 per foot year after year in a certain city. No attempt has been made to find what it costs other agencies to install similar work. Later, there comes to your attention the costs of several cities or companies and, upon comparison, you are astonished to find that the average cost for laying 6-in. water pipe is only $2.13 per foot. You would surely make a decided effort to locate this difference in expenditure. The above test can be applied to each and every operation that is essential in the water system, but to do this there must be uniform cost keeping among municipalities.

In modern commercial concerns the officials find that it is less costly to profit by the mistakes of others than to learn through their own experiences. For this particular purpose they have issued cost accounting statistics through which they obtain cost ratios and percentages that enable them easily to detect and remedy any items of expense that are too high or too low. They find that through comparison with like businesses they may learn their own comparative expense and are thus enabled to set about making changes necessary to increase their profits. The municipal water department or water company can be run on the same general plan.

Value of Uniform Records.—Through uniform cost accounting records we are enabled to tabulate the costs of each size of main laid during any period. These can again be divided according to foremen, which affords information that will allow the elimination of nonproducers. This may bear an important relationship to future lower costs, which, in itself, may more than doubly compensate for the expense of obtaining the information.

If you are to be certain that your schedule of charges for water consumption is adequate, you must know the exact expense of producing a unit of salable water. This can be accomplished only by having a definite procedure for your guidance. If you fail to do this, there are items that will be forgotten, items of which you have no immediate record, items that you may leave for proration until some other time. The form you use should tie up definitely with your general accounting records. This will leave nothing for you to forget. You can then say definitely, for instance, that it costs 17¾ ct. per thousand gallons for your gross pumpage and 21 ct. per thousand gallons for water actually paid for by the consumer.

It is necessary to know not only the total cost but the exact cost of each operation that goes to make the completed unit. Following this procedure we discover items of excessive expense and can set about to remedy them.

In municipal utilities the users and taxpayers are the stockholders. They cannot directly share in the profits but a minimum outlay of money by them for a particular utility means a saving, and consequently a profit, to them. It devolves upon you, therefore, as administrative officials, to show the stockholder that his public utility expenses are low as compared with his outlay for other necessities. In this way the municipality as a whole will know that the profits are clearly shown and that you have played your part well.

Acknowledgment.—The foregoing is a paper presented at the Second Annual Conference of the Maryland Water and Sewerage Association.

Cost of Sewage Maintenance at Baltimore, Md.

In our issue of November 1928 there was published on page 255 a table showing data from several cities on sewerage maintenance. In compiling this table the writer obtained his information from various city officials, and noted in his paper that it was possible that some corrections should be made, realizing that some error may creep in.

In the case of Baltimore it is found that this condition exists and that the annual cost of maintenance for the sewers only should be $291,300.00 rather than the amount published. This difference will make the cost per mile $338.70, the cost per million gallons $13.28, and the cost per assessed valuation $0.015 per $100.00.

Millions Voted for Airports

By the popular voting of millions of dollars for airport construction, airports have been established as public utilities.

Nearly $8,500,000 was voted for airports at the November 6 elections. Eleven cities or counties passed bond issue propositions ranging in amount from the $5,000,000 voted by Detroit to the $25,000 approved by the people of Albany, Oregon.

In a few localities the bond issue proposition for airports was defeated but in most such instances the failure was due to circumstances which had nothing to do with the public attitude toward aviation. In Chicago, for example, where every bond issue presented by the present administration in the last two elections have been defeated, the item of $450,000 for development of the airport received the highest vote of all among the defeated projects.

During the last year appropriations or bond issues have been passed which involve more than twenty-one millions of dollars, all of which is to be spent in supplying cities and counties with needed airport facilities.

"The airport," said Captain L. D. Seymour, Assistant General Manager, National Air Transport Co., "has become a public Utility. Communities have come to realize that the benefits of the airport are general. Every aspect of a town's life is affected by the provision of an airport. At Columbus, O., organized labor worked as hard for the passage of the airport bond issue as any group of capitalists. Increased possibilities for all classes of labor were foreseen in the construction and operation of the airport and, more particularly, in the industries which will inevitably follow the establishment of the airport.

"The status of the airport as a public utility has been definitely established. The Supreme Court of Missouri has so ruled, in passing judgment on the validity of airport bonds voted by St. Louis and Kansas City."

In the preliminary designs for the majority of the proposed airports many improvements are included which would have seemed visionary to aviators of pre-war days. Administration buildings are proposed which equal modern railway terminal buildings in size and usefulness. Lighting equipment, air weather bureaus, permanent, fire-safe hangars and paved runways are but a few of the features which have become commonplace in the design of airports; none of these was to be found on any American port ten years ago.

Outer Park System for St. Louis Recommended.—An outer park system which would give St. Louis, Mo., recreation spots in scenic parts of St. Louis County is urged by Fred W. Pape, Park Commissioner, in his annual report to Director of Public Welfare Salisbury.

DISTRIBUTOR NEWS

The Distributor's Department in the Gillette Construction Group

Happy New Year

Santa Claus left us a few distributor stories, so that means a Happy New Year for us. We hope your Christmas stockings were so full of orders that your warehouses will be left quite empty until fresh supplies arrive from the manufacturers, which will mean a Happy New Year for you.

Ninteen twenty-eight is now ancient history and we all have a new Carry On spirit for 1929. We are looking forward with pleasure to a better acquaintance with the distributors in the field, and an opportunity to present their stories to our readers.

Take advantage of this department which is at your service. If you remodel or build a warehouse, open a new office, elect officers, appoint new representatives, or go on a business trip, tell Distributor News about it. We will pass the stories of your progress on to our readers. It is a source of inspiration to the field to learn of the activities throughout the country and to know of so many men all engaged in the same line of endeavor.

Pictures add to the interest of a story, so send us your cuts or photographs of facilities or officials of your company. We are glad to hear from you and will use your contributions as far as space permits. Write us often. Address all communications to The Editor, Distributor News, Gillette Publishing Company, 221 East 20th Street, Chicago.

Localized Gatherings

One Way to Help Distributors

By LOUIS McLOUTH

Advertising Manager, Sauerman Bros., Inc., Chicago

EVERY manufacturer of industrial equipment holds an annual sales convention, which gives salesmen and distributors a chance to visit the factory and hear an outline of plans for the coming year. Sauerman Bros., Inc., of Chicago, manufacturers of slackline cableway excavators, power drag scrapers and coal-storage equipment, hold an annual sales meeting, but this convention is taken to the distributors. In other words, the Sauerman plan embraces a series of small, localized gatherings, rather than one big central get-together.

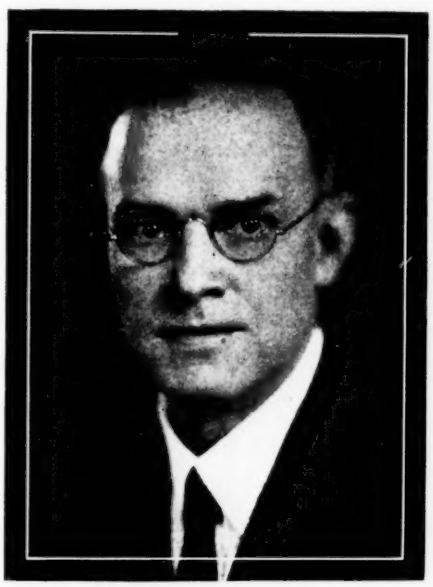
It would be easier and simpler for Sauerman Bros. to follow the line of least resistance, have their distributors and the latter's salesmen come to headquarters once a year, and call it time and money well spent. Analysis of the situation, however, convinced the company's officers that the greatest possible good could be accomplished by the sectional gatherings, which would be devoted, not to a discussion of national conditions, but how to sell the company's three main lines in the specific territory covered by that distributor and his men.

Thus every fall a flying wedge starts out from the Sauerman plant in Chicago, headed for the home territory of distributors in almost every part of the country. This flying wedge is made up of D. D. Guilfoil, sales manager; the advertising manager; W. R. Elden and H. A. Roe, engineers, and the district sales manager for the section being invaded.

On November 14 and 15 this quartette held a meeting with the distributor for the Indianapolis territory. Earlier in the month, November 8 and 9, it went over the situation with the distributor at Dayton, Ohio. Other meetings have been or will be held in St. Paul, Milwaukee, Detroit, Baltimore, and New York.

The local convention plan was adopted after it had been determined from contact with distributors and general observation that conditions in almost every part of the country differ from those in any other section. One territory may be prosperous and another may be experiencing a depression; one section may be chiefly agricultural and another may be mining; demand in one territory may be chiefly for excavators, while in another it may be largely for coal-storage equipment.

This being true, Sales Manager Guilfoil decided that the logical way to approach the sales problem was to break down the country into sections, as covered by distributors, and then to join the distributor, at least once a year, in a face-to-face discussion of what could be done to increase sales in that particular territory. The distributor's salesmen, of course, come in for the local meetings and present their own individual problems.



Mr. Louis McLouth, Advertising Manager, Sauerman Bros., Inc.

This means a lot of work for the men elected to attend these district meetings from the main office. The sales manager, even if he were so inclined, could not dismiss the discussion of selling scrapers to contractors in Ohio with a few glittering generalities. The advertising manager cannot quote a few figures showing how his company covers prospects with advertising all over the country.

On the contrary, Mr. Guilfoil goes before each meeting with a sheaf of sales statistics compiled for that particular group of salesmen. I cannot content myself with totaling the country-wide circulation of advertising mediums employed, but must break that circulation down by states, so that I can and do tell distributors and their salesmen just how many sales messages are being fired every year in their own territory.

The time spent in making these territorial breakdowns is justified in more ways than one. I learn a lot when I get this slant on the advertising situation. Likewise, the distributors' salesmen are more forcibly impressed with the figures relating to their own territory than they would be with the national coverage, because the latter has only a general meaning to them. But when you start talking about advertising in their own territory, and to the men they are trying to sell, you get both an intensely interested and a highly enthusiastic audience.

The same is true of the addresses of the sales manager, the district sales manager and of the engineers. They localize their data as far as possible, so that their remarks are made with a consideration of local conditions and to men who have to meet those conditions.

It is gratifying to see the impression made on distributors and their salesmen by the advertising circulation figures. They had no idea that the number of magazines, consolidated catalogs and directories spreading our advertising message throughout their territory was so large. After looking at these figures, their conclusions seem to run something like this: "Well, we don't see much about excavators and drag lines in the newspapers, but the figures show that it is really a big business—one we can be proud of."

They leave the convention with renewed enthusiasm, as well as additional facts which they can use in their daily work.

Most of the Sauerman district meetings are held in November and December, when the demand upon the sales department is at the lowest pitch of the year. The meetings are thus held with a minimum of loss of business.

The meetings are of the blackboard and brass tack variety. They are far more intimate than would be possible under any other conditions, and because they are intimate and of a man-to-man nature, salesmen who might ordinarily feel some constraint make bold to come out and state any problem which is bothering them. The sales manager gives the answer in the same frank way, and all of those present gain from the discussion.

The meetings are held in the quarters of the distributors in some cases and in a local hotel in others. The average meeting lasts two days. While the days are devoted to business, the entertainment feature is not omitted, one of the local hotels providing facilities for a dinner and any other program which may be desired.

The Sauerman headquarters staff is constantly on the road during these two months, and the convention period is quite a strain because of this long absence and the continuous traveling. Only the conviction that more in the way of actual results is accomplished in this way than in any other would justify this arduous effort. But Sauerman Bros. have given the plan a thorough trial, and as far as they are concerned the old mass convention is a thing of the past.

Distributor Notes

The Sidney Steel Scraper Company of Sidney, Ohio, of which Mr. John Perry is president, announces the organization of the International Automotive Equipment, Inc., a new corporation for the purpose of marketing the new patented Perry Automatic Dump Truck Body. The Sidney Steel Scraper Company has contracted to manufacture bodies on order of the Sales Corporation. The new body will be shown at the Road Show with the exhibits of the Sidney Steel Scraper Co. and the Perry Company.

Arthur E. Little

Mr. Arthur E. Little, well known in the industrial advertising field passed away after a brief illness. Mr. Little was formerly advertising manager of the Thew Shovel Company at Lorain, Ohio, and was one of the speakers at the 1928 convention of the National Industrial Advertisers' Association at St. Louis.

He was a technical expert and capitalized his knowledge in the industrial advertising field. Previous to going into the advertising work he served as a draftsman with the Cleveland Frog & Crossing Company, and chief engineer of the Jahant Heating Company. He then became connected with the advertising department of the Firestone Rubber Company, and after the war served with the Paul Teas, Inc., Cleveland and the Thew Shovel Company, Lorain.

Charles Seitz

In the recent and tragic death of Mr. Charles Seitz, the United States Cast Iron Pipe & Foundry Co., of Burlington, N. J., has lost a respected and able member of their organization. Mr. Seitz's death was the result of an automobile accident which occurred on November 30th. At the time of his death he was the Resident Manager of the Addyston Shop.

Mr. W. E. Lewis, formerly Resident Manager of the Anniston Shop of this organization has been transferred to Addyston, to fill the position left vacant by Mr. Seitz.

Branch Manager Transferred from Milwaukee to New York

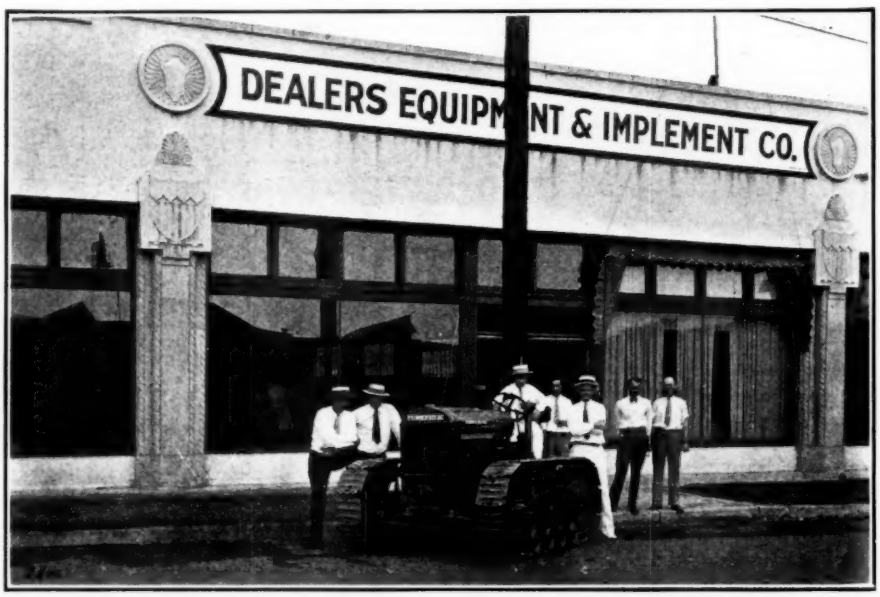
Mr. H. N. Felton, formerly branch manager of the Milwaukee office of the Wagner Electric Corporation, St. Louis, has moved east to take charge of the New York office. Mr. Felton is a graduate of the University of Illinois, and served two years in the Army. He entered the Chicago district of the Wagner Company as a salesman and in 1927 was made branch manager of the Milwaukee Branch, where he continued until he was transferred to New York.

In Southern Territories

THE Dealers Equipment and Implement Co., Memphis, Tenn., distributors for the McCormick-Deering Industrial tractor and the Trackson Company's lines of equipment, have found the Trackson McCormick-Deering unit an ideal crawler tractor for road building and maintenance, according to Mr. Dunbar Abston, Vice President of the Company.

Highway work is this company's most important sales field, and the Model DH Trackson unit has proved an economical, efficient solution to the equipment problem. This year, especially, the Memphis territory is occupied with extensive road work and levee construction programs and State, County, and City officials have shown tremendous interest in the Trackson McCormick-Deering combination.

The accompanying illustration shows officials of the Dealers Equipment and Implement Co., and other members of the organization grouped around the Trackson in front of their attractive show rooms. Mr. Abston is shown at the wheel of the tractor; Robert Rust, Manager, is third from the left, with his arms folded, and Irvin Kunert, Trackson Company representative, is first to the right of the machine.



Mr. Dunbar Abston, Vice-Pres. of Dealers Equipment & Implement Co. at Wheel of Tractor; Mr. Robert Rust, Manager, Third from Right, and Mr. Irvin Kunert, Trackson Co. Representative, Immediately at Left of Tractor

The Offices of MUNICIPAL NEWS AND WATER WORKS, 221 E. 20th Street, Chicago, are headquarters for information on equipment and supplies. If you want catalogs, prices or names of manufacturers, we will gladly supply same free.

Convention of Corrugated Culvert Makers Held at Massillon, Ohio

Late in the fall a meeting of the Toncan Culvert Manufacturers' Association was held at Massillon, Ohio, to formulate plans for selling and advertising activities for 1929. The members assembled in the executive offices of the Central Alloy Steel Corporation.

The utmost optimism was expressed regarding the business outlook for 1929, and practically every section of the United States and Canada was represented at the conference. A considerable expansion of the Association's trade activities was decided upon to be started at once.

Several new members, acknowledged leaders in their respective territories, joined the Association during 1928, thereby adding strength to the organization, and plans have been made for enlarging the membership still further in 1929. Officers for the ensuing year were elected, and a meeting scheduled for August.

Change of Address

The Cutler-Hammer Company of Milwaukee, Wisconsin, announces that after December 1st the address of their Atlanta, Georgia, office will be 150 Peters Street. This office will furnish sales and engineering service on Motor Control apparatus and Wiring Devices, and will also have warehouse facilities for carrying in stock many types of standard devices. This will insure to customers in that territory direct and prompt shipment. Because of the increasing electrical power application to industry in this section of the country the Cutler-Hammer Company has provided this service to anticipate the needs of its customers. Mr. A. C. Gibson is manager in charge of the Atlanta office.

The Power Plant Supply Company, sales engineers and contractors, who have been in business in Detroit since 1911 announce their removal from the Penobscot Building to the new Fisher Building. They will be established in their new quarters after the first of the year. Mr. J. E. Walsh is general manager for this firm.

After January 1st, the address of the Eastern Paving Brick Manufacturers Association, will be 1535 Real Estate Trust Building, Philadelphia, Pa. Mr. William C. Perkins is the Chief Engineer of this organization.

Distributor Notes

The Ross Power Equipment Company, dealers in new and used equipment issue a very complete catalog of their stock. It is well classified and each piece numbered, making it very easy to inquire about any particular piece of machinery. Their announcement states that they have a background of thirty years experience in the power plant and general machinery business. If interested, write to them for a copy of this catalog. They are located at 9-11-15 South Meridian Street, Indianapolis, Ind.

New England Implement Co. Adds McCormick-Deering Line

The New England Implement Company with large establishments at both Boston and Worcester, Mass., is one of the oldest Trackson distributors in the country. They have sold hundreds of Trackson units in New England for road work and snow removal purposes which are their biggest sales fields, and also for general construction work.

Their tractor and equipment business is one of the largest in the East and they recently took over the distribution of McCormick-Deering tractors and the Trackson Company's lines of Full Crawlers and other equipment adapted to use with the International power plant.

Eastern Distributors Add Line of Tractors

Because of the increasing importance of the tractor as a power plant for highway, general construction and industrial purposes, the Tractor & Equipment Company of Newark, N. J., for many years dealers in automobile bodies have added tractors to their equipment line. This company was recently appointed distributors for the Trackson Company of Milwaukee, Wis., to handle Industrial McCormick-Deering tractors and also the Trackson full-crawlers, loaders, shovels and other equipment for the International tractor.

Messrs. Lyman and Holloway of the Tractor & Equipment Co., enthusiastically report a keen display of interest in the outfits making up the Trackson-McCormick-Deering combination. A variety of fields for tractor and equipment sales is offered in the metropolitan industrial section which comprises their territory.

We present a picture of a Model DH Trackson McCormick-Deering unit with Mr. Lawrence Coons at the wheel making a test before equipment is delivered.

Warehouse and Showrooms of Tractor & Equipment Co., Distributors at Newark, N. J. Mr. Lawrence Coons, Tractor Salesman at Wheel of Model DH Unit

New Lines Wanted

Editor's Note—Distributor News receives from time to time letters from distributors wishing to be put in touch with manufacturers of certain lines of equipment which they would like to represent. Items of this kind will be published and names and addresses furnished interested persons upon request.

A man of many years' experience in the machinery business in the south would like to make a business connection for the sale of road machinery equipment.

Machinery company in the east is interested in representing established lines of road machinery, with the exception of graders.

New York company interested in representing manufacturers not already established in eastern market, or considering a change in sales arrangements.

Manufacturers' representatives located in New York would like to add line of heavy contractors' equipment of established reputation, other than the lines now handled by them. They would like exclusive sales rights for such equipment.

A Michigan distributor of many years experience, representing at this time many prominent manufacturers of pumping machinery, offers the services of an established representative to manufacturer needing increased distribution facilities in this region.

A contractor's superintendent located in Florida would like to represent some road equipment manufacturers in this territory.

A manufacturer of paving expansion joints is looking for distributors for Northern California territory.

New Appointments

The Continental Motors Corporation, through the manager of its Industrial Division, Mr. L. J. Kanitz, announces the appointment of Mr. Sid Harris as Industrial Sales Engineer in the East, a field in which Mr. Harris has a wide knowledge.

Independent Pneumatic Tool Company to Enlarge Plant

The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, manufacturers of Thor Pneumatic, Electric and Contractors Tools, will build an addition to their factory located in Aurora, Illinois.

The new structure will consist of a modern, fire-proof, concrete construction building and will add 36,000 square feet to their present capacity.

Caterpillar Acquires Russell Grader

On December 13th the Caterpillar Tractor Company announced by telegram that negotiations, which had been pending, had been concluded with the Russell Grader Manufacturing Company of Minneapolis, whereby it had acquired the business and facilities of the latter company. The plant formerly occupied by the Russell Grader Company at Minneapolis will be used by the Road Machinery Division of the Caterpillar Company where they will continue to manufacture the Russell line of road building machines. Hereafter all Caterpillar tractor dealers in this country and abroad will have charge of the sale of Caterpillar tractors, Russell road machinery and Holt combined harvesters. The latter are produced in the harvester division of the Caterpillar Company located at Stockton, California.

The Caterpillar Company, whose headquarters are in San Leandro, California, has announced its intention to build an eastern combined harvester factory at Peoria, Illinois, where its principal tractor plant is now located.

Timken Roller Bearing Co. Establishes Permanent Offices in Far West

The Pacific Coast territory of the Timken Roller Bearing Company has been reorganized, with the result that a permanent office has been established in Los Angeles, California, and one in Seattle, Washington. Mr. Roy Cross, located at 1361 South Figueroa Street, will have charge of the Los Angeles office, and Mr. Marshall Cooledge with address at 321 South Pine Street will direct the Seattle office. Mr. G. C. McMullen will continue to serve from the Company's San Francisco office as district manager.

Construction Machinery Co. Plan Road Show Dinner for Representatives

Mr. R. C. Weller, sales manager of the Construction Machinery Company, Waterloo, Iowa, announces that their annual dinner for representatives will be held at Cleveland at the time of the Road Show. The dinner will take place at the Cleveland Hotel, Monday evening, January 14th. Discussion will center around the many interesting features of the combined Construction Machinery and Marsh-Capron program for 1929, according to Mr. Weller's announcement. Indications point to many improvements to be offered in the new models which are to be shown under the Wonder or Marsh-Capron banner at the Show.

The Construction Machinery line is now one of the most complete in the field with Wonder Tilting Mixers; Marsh-Capron Drum Type Mixers; Mechanical Hoeman Plaster Mixer; Power Sawyer; Construction Machinery Company Hoists and Blackhawk Snow Plows.

New Sales Manager Appointed by Penn. Dixie Cement Co.

The appointment of Mr. Walter S. Wing as General Sales Manager for the Pennsylvania-Dixie Cement Corporation has just been announced. Mr. Wing will be in general charge of the marketing

Mr. Walter S. Wing, General Sales Manager for Pennsylvania-Dixie Cement Corp.

of the corporation's products and will be located at 131 East 46th Street, New York City.

Mr. Wing entered the steel business in Pittsburgh, during the summer of 1907, following his graduation from Cornell University with the degree of Mechanical Engineer. About a year later he was transferred to a subsidiary company, the Universal Portland Cement Company, where he remained until very recently. For the past 13 years his office has been in Pittsburgh, where he served the Universal Company as Eastern Sales Manager.

Public and civic affairs have always interested Mr. Wing and he has taken part as an active member of the United States Chamber of Commerce, Pennsylvania State Chamber of Commerce, Ohio State Chamber of Commerce, Pittsburgh Chamber of Commerce and the Civic Club of Allegheny County. He is also a member of the American Society for Testing Materials, Cornell Society of Engineers, and in Pittsburgh is a member of the Duquesne Club, University Club, Longue Vue Club, Railway Club of Pittsburgh, Automobile Club of Pittsburgh, Pittsburgh Builders Exchange and others.

Browning-Ferris Co. to Handle Tracksons

The Trackson Company, Milwaukee, Wis., manufacturers of Trackson Full-Crawlers, Loaders, Shovels, Cranes, etc., announce that they have arranged with the Browning-Ferris Machinery Co., 205 Exposition Ave., Dallas, Texas, for the distribution of Trackson equipment for McCormick-Deering Tractors.

These distributors will have the entire state of Texas for their territory. They also have branches in Houston, Fort Worth, and Amarillo. They are authorized distributors for McCormick-Deering Industrial tractors, and are in a position to give quick service on the International and Trackson lines.

Wemlinger, Inc., Opens Chicago Office

Word has just been received that Wemlinger, Inc., 149 Broadway, New York City, has opened an office in Chicago at 228 North La Salle Street. This office will be under the direction of Mr. Alexander Mayer who is thoroughly equipped to help the contractors in all matters concerning steel sheet-piling and to render many services to the customers of Wemlinger, Inc. Practical suggestions concerning the product of this company is mailed out in unique folder style each month to interested users of piling. This service is called "Piling Facts" and a line to either the Chicago or New York office, we are sure, will place your name on the mailing list to receive this information.

New Appointments

The Harnischfeger Corporation of Milwaukee, Wis., has enlisted the services of the Ed. P. Phillips Machinery Co., of Richmond, Va., as new district agents for the Virginia territory.

The Phillips Machinery Co., has satisfactorily supplied the needs of a large number of Virginia contractors, over a period of many years. They will handle the complete line of P & H Excavating equipment, including shovels, draglines, clamshells, trench-hoes, skimmer scoops, trenchers and backfillers.

Announcement has been received that McCarthy-Jones & Allen Co., Inc., 111 First Avenue, South, Nashville, Tennessee, has been appointed distributor of all the products of the Botfield Refractories Co., Philadelphia, Pa., manufacturers of Adamant Fire Brick Cement; Adamant-Adachrome Super-Refractory Mixtures and the Adamant Gun.

Murray - Wheeler Company, 329-31 Ellicott Square, Buffalo, New York has been appointed distributor for the Eastern territory for the Erie Machine Shops, Erie, Pennsylvania, manufacturers of Erie steam and gasoline rollers.

Municipal Official
Contractors
Engineers

Valuable Information Yours for the Asking

Write Now

Catalog Service

Useful Equipment Information

Watch these trade announcements for new and improved equipment

By writing the manufacturers named and mentioning this magazine, copies of the following catalogs will be sent to you without obligation

TRADE PUBLICATIONS

Hose Coupling Vib-Restor.—This is the trade name given to the latest addition to the pump industry by the Chicago Pump Company, 2336 Wolfram Street, Chicago. This is a vibration deterrent for horizontal centrifugal pumps presented by the engineering department of this company. It is a scientifically designed rubber hose coupling, special rubber fabric and special couplings being employed in the manufacture. This coupling is recommended by this company where a quiet pump installation is desired. If interested write to Mr. Clem Peterson, at the above address for folder on Vib-Restor. If you will mention this magazine it will be appreciated.

Water Softeners.—The International Filter Company, 333 West 25th Place, Chicago, present in an illustrated bulletin Crystalite, a water softening product. This is an attractive 16 page booklet, well printed on heavy enamel paper. It discusses the chemistry of zeolite water softening; the early history and development of zeolites; Crystalite as a super rapid zeolite; the advantages of upflow softening illustrated with curves. Crystalite Water Softeners installed by the International Filter Company are illustrated, and special industrial uses for Crystalite are listed. If writing for this bulletin, kindly mention our magazine.

Distribution Transformers.—Bulletin 160, recently issued by the Wagner Electric Corporation of St. Louis, Missouri, is a 52-page catalog describing Wagner distribution transformers in a single-phase and three-phase, pole type and subway-type, in ratings up to and including 500 Kv-a. Detailed description of design and construction of these distribution transformers fills the first half of the catalog, while the remainder is given over to ratings, shipping weights, prices, etc. Mr. C. B. Dietrich, identified with the St. Louis office of this company at 4600 Plymouth Avenue, will be pleased to send you a copy of this book on request. If you will mention this magazine it will be appreciated.

Chlorination.—Wallace & Tiernan, Newark, New Jersey, manufacturers of chlorine control apparatus will be pleased to send you full particulars in regard to the sterilization of water by their method, and to furnish you with record of cities where their apparatus is being used. If writing for information, we would like to have you mention our magazine.

Dual Control Trencher. — Bulletin 20-X gives detailed information regarding the P & H Trencher manufactured by the Harnischfeger Corporation, 3902 National Avenue, Milwaukee, Wis. One of the important features of this equipment is the fact that the operator can work from either side. This company has branches in all the principal cities. Write to Mr. H. S. Strouse for copy of this bulletin, mentioning this publication.

Dragline.—Write to Koehring Company at Milwaukee, Wis., or to any of their branches in the principal cities, for Dragline Bulletin DL9. The ease of control and speed in functioning are important features of this heavy duty Koehring equipment. Mr. O. C. Dahlman will furnish bulletin on request. If writing mention our magazine.

Centrifugal Pumps.—Write to De-Laval Steam Turbine Company, Trenton, N. J., for Catalog B-64, which gives detailed information concerning the reliability and economy of these pumps, which are widely used by American municipalities for automatic pumping stations. In writing to Mr. H. B. Watson of this company for the bulletin, kindly mention our publication.

Francois Cementation Process.—The Dravo Contracting Co. have acquired the sole American rights to the Francois patents, and have a highly skilled staff who will be pleased to help you with your problems. This method of grouting covers chemical processes for a hundred and one different cases, the engineers of the Dravo Company are ready to help you solve your problems. Write to their company at Pittsburgh, Pa., mentioning our magazine.

Sewer Cleaning Machine.—W. H. Stewart, whose factory is at Walkerville, Ontario, has branches in St. Louis, Mo., Jacksonville, Fla., and Boston, Mass., so that his patrons on this side of the border may be served without paying duty. Literature describing his sewer and conduit rods will be furnished on request. Rods will be shipped on trial. If writing to Mr. Stewart for information concerning his equipment kindly mention our publication.

Manhole and Catch Basin Covers.—Write to Wm. E. Dee Company, 30 North La Salle, Chicago, Ill., for particulars concerning the different types of manhole and catch basin covers. Prices will be included on request. If writing, kindly use the name of our magazine. This company also manufactures sewer pipe, drain tile, culvert pipe, well tubing, flue lining, wall coping and fire brick.

Cast Iron Pipe.—The U. S. Cast Iron Pipe and Foundry Company of Burlington, N. J., have branches in all the principal cities and will be pleased to send you full information if you will state your requirements. They manufacture pipes for all purposes. If writing for information, will you mention our publication.

Hydrants, Valves, etc.—Full particulars for supplies needed by water works and fire departments will be sent upon request by the Bourbon Copper & Brass Works Co., 618 E. Front St., Cincinnati, Ohio, manufacturers of fire hydrants, gate valves, and extension valve boxes. Write for their catalog, giving the name of our magazine.

Trencher.—Details and specifications of the new Parsons Model-31, the big full-crawler trencher, manufactured by the Parsons Company, Newton, Iowa, may be secured upon request. Before offering this machine to the market it was given a thorough test by its sponsors and they would like to tell you all about it. Like its predecessor, the Parsons 21, the 31 is built to dig at either side or in the center and digs with boom offset so that it can handle close-quarters jobs where some machines might fail.

Valves.—Golden-Anderson Valve Specialty Company located in the Fulton Building, Pittsburgh, have issued a descriptive and data catalog on their automatic valves for steam and water service. Full details are given on each page as to construction, operation variations together with cross-section drawings. Data required for ordering is made very clear. If you desire a copy of this catalog write to Mr. J. A. Voland of the Golden-Anderson Company mentioning the name of our magazine.

Meter Testers.—A catalog giving complete information on the Mueller Meter Tester will be sent upon request if you will write to Mr. C. N. Wagenseller of Decatur, Illinois, mentioning this publication, or they may be secured at any of the branch offices of this company. The Mueller Meter Testers are simple of operation and of a lasting quality of construction. Statistics show that meters under-register oftener than they over-register and an accurate meter tester insures honestly earned revenues. Meters should be tested befor installation and at regular periods

thereafter. The Mueller catalog will give you complete information on this subject.

Zeolite.—"Softening Municipal Water Supplies by the Use of Zeolite" is the title of a bulletin issued by the Zeolite Chemical Company, 140 Cedar Street, New York City. This booklet describes Green Sand, a natural base exchange Zeolite Mineral, used for the purpose stated. Write to Mr. R. E. Wagner of the Zeolite Company for a copy of this bulletin. If writing, we would appreciate it if you would mention this magazine.

Meters.—The Union Water Meter Company of Worcester, Mass., with offices in New York City and Philadelphia, will be pleased to send you literature concerning their King Frost Protected Meter, built to overcome every known weakness in frost meter design. If interested in meters of this type write to Mr. E. K. Otis for full particulars. We would appreciate it if you would mention this publication.

Hydrants and Valves.—The Mathews Fire Hydrants, built for easy installation and so that an extension section may be used to adapt them to new grades, are described in literature of the R. D. Wood & Co., Philadelphia. If you will write to Mr. C. Becker of this company he will gladly send you full information about their sand-cast and "sand-spun" centrifugal cast iron pipe fittings, valves, boxes and hydrants. Please use the name of our magazine if writing.

Automatic Air-Lift.—The Sullivan Machinery Company, 130 South Michigan Avenue, Chicago, Ill., has a handbook on their atuomatic air lift, and special automatic control information of particular interest to water works superintendents. A letter to the Sullivan Machinery Co., attention of Mr. S. B. King, will bring you this information. Ask for Catalogs 6171-I and 6156-J. If you will mention the name of our magazine we will appreciate it.

Filtration Plants.—Officials considering filtration plants will find much interesting information in the literature of the Norwood Engineering Company, Florence, Mass. If writing mention our paper.

Cast Iron Pipe.—James B. Clow & Sons, 201-299 North Talman Avenue, Chicago, with foundries at Coshocton, Ohio, Newcomerstown, Ohio, and Birmingham, Alabama, carry large stock of pipe at points where large supplies can be obtained on short notice. Wire or write them concerning your requirements, they will be glad to care for your needs without delay. Mention our magazine when writing this company.

Lubricant.—The Dot Lubricant Equipment Company, Division of the Carr Fastener Company, Cambridge, Mass., has issued a unique little folder called "Little Journeys in Dot Lubrication," illustrating and describing the various steps in the use of this lubricant. The trip described is that of taking the grease from the storage tank to the bearings quickly, comfortably for the user, absolutely free from dust and dirt.

Centrifugal Pumps.—In order to be of assistance to users in choosing the right pump for their needs, Bulletin 1632-I has been issued by the Allis-Chalmers, Milwaukee, Wis. Types for steam turbine drive, motor drive or gasoline engine drive are described to best fit the purposes of installation. Write to Mr. H. G. Hoffman for copy of this bulletin, mentioning Municipal News and Water Works.

Sanitary Specialities.—Manufactured by the Servicised Products Corporation include Bituminous rope, sewer compound and sewer belts (both acid and root proof), and asphalt liner slabs, proof against sewer liquors. Illustrated literature giving complete descriptions and details concerning these products for obtaining permanently tight and lasting sewers will be sent upon request by the Servicised Products Corporation, 6051 West 65th Street, Chicago, Ill. If you will mention our publication when writing to Mr. A. C. Fischer of the Servicised Company for this information it would be greatly appreciated.

Moir-Buchanan Centrifugal Process.—This process is to obtain high density, low absorption and long life of concrete pipe. Rights to use this process may be secured through the Asphalto-Concrete Corporation, 1440 Broadway, New York City. If interested in learning about this process and how strength and durability are secured by this method write to Mr. Geo. H. Schroder of the Asphalto-Concrete Corporation, using the name of our magazine and ask for full particulars.

Chlorinator.—Bulletin W-21 issued by the Paradon Manufacturing Company of Arlington, N. J., describes in detail the Paradon Chlorinators for city and private water and sewage systems, industrial plants and swimming pools. If writing for this bulletin address Mr. R. V. Donnelly, care of the manufacturer. We would appreciate it if you would mention our publication.

Cast Iron Pipe.—The Central Foundry Company, manufacturers of cast iron pipe with offices located in the principal cities, will be pleased to have you call at the nearest office or write to the New York office, 420 Lexington Avenue, for complete information in regard to their product, an iron to iron joined pipe, allowing for expansion and contraction, vibration and uneven ground settlement. Used for water supply, fire protection and other service.

Valves.—The Darling Valve & Mfg. Company with offices in New York, Chicago, Houston and Oklahoma City and headquarters in Williamsport, Pa., will be pleased to send you full information in regard to the design and performance of their valves which are built to minimize friction and wear. If writing for literature to Mr. A. G. Smith at the Williamsport office of the company, kindly use the name of our magazine.

Pipe Cutting Tool.—A folder from the Tucker Company, Inc., 75 Murray Street, New York City, illustrates and describes the Anderson pipe cutter for cast iron pipe. This tool can be used in any ordinary trench without extra excavating, and will make a clean cut in gas or water main in the trench. All parts are of steel or malleable iron. Prices for the cutter in different sizes are given, as well as a price-list of all parts. Further information will be furnished upon request. If writing kindly mention this magazine.

Rayflectors.—The trade name of patented reflecting devices designed for utilizing light from automobile headlights, or other outside sources, to make signs and signals visible at night. The Rayflectors are manufactured by the Ray-Signs Corporation, of New Haven, Connecticut, and are described and well illustrated in a very attractive, well bound, 12-page booklet. These devices come in three sizes and in white, red, green and amber. This black and gold booklet will be sent upon request by the manufacturer, and we would appreciate it if you would mention our publication when writing.

Road Maintenance.—Several attractive pieces of literature have been received recently from Edw. J. Jockoboice, Grand Rapids, Michigan. A 12-page enamel-paper booklet describes in detail and illustrates the Monarch Road Planer and Maintainer. The sharp and carefully lettered and numbered illustrations both in this booklet and in broadsides issued by this company make it easy to comprehend the outstanding features of this machinery. The blade on the "Perfection Reversible Monarch" Road Planer is set with swinging arms attached to each side of the truck which allows the blade to be swung to reserve angle, thus whether cutting to or from the center of the road the truck is always with traffic.

Seal Tight Expansion Joints.—The necessity for expansion joints, types that have been used, types of premoulded joints, etc., are discussed in a little booklet called Seal Tight issued by W. R. Meadows, Inc., Elgin, Illinois. Allowances must be made for the expansion and contraction of concrete as affected by weather conditions, and this booklet gives results as accomplished with Seal Tight in controlling this problem. Write to Mr. W. R. Meadows at Elgin for complete information regarding these expansion joints, mentioning the name of our magazine.

Portable Compressors.—Ingersoll-Rand Company, 11 Broadway, New York City, will be glad to send you catalog describing their gasoline engine or electric driven portable compressors, in six sizes. If writing for this information, will you please mention our magazine.

Lubrication.—The story of the Alemite Manufacturing Corporation system of lubrication issued in magazine style. This pamplet, Lubrication Maintenance, is published in the interest of better industrial lubrication and lower production costs, and will be mailed free to any one interested. If writing for this booklet, will you kindly mention our publication? The address of the Alemite Manufacturing Company is 2646 North Crawford Avenue, Chicago.

Four Wheel Drive Trucks.—Several pieces of literature have just been received from the Coleman Motors Corporation, of Littleton, Colo., Washington, D. C., and Chicago. The trucks described and illustrated are Model C-25 (2 tons), Model D-40 (3 tons), and Model X-100 (5 tons). Specifications are given and the trucks are shown performing seemingly impossible feats. The front axle of the Coleman truck is placed under the frame at a point that will give an equal distribution of weight upon both axles when the truck is loaded to capacity. This factor adds to the tractive ability and to tire life. Full information regarding any or all models will be sent upon request addressed to any office of the manufacturer. If writing we will appreciate it if you will mention this publication.

Steel Sheet Piling.—Lackawana Steel Sheet Piling, particularly suitable for the long sea wall. For information regarding this product write to the Bethlehem Steel Company, Bethlehem, Pa. Mr. S. H. Yorks is sales-manager. If writing Mr. Yorks, give the name of our magazine.

Hydraulic Dredge Capacity Indicator.—The Ellicott Machine Corporation, 1111 Bush Street, Baltimore, Maryland, specialists in dredging outfits, are equipped to furnish you with well designed hydraulic dredge, either diesel, electric, gasoline or steam driven, built for efficient and economical service. Mr. C. E. Ellicott, Jr., will be pleased to furnish you full information concerning outfits for jobs of all sizes. If you will mention this magazine, he will send for your convenience a hydraulic dredge capacity indicator.

Steel.—Write to the Inland Steel Company, 38 South Dearborn Street, Chicago, Ill., for information regarding their Inland Copper Alloy Steel Sheets, made for resisting corrosion. State your requirements and particulars will be given to you on sheets, bars, plates, shapes, rails, track accessories, rivets, billets, etc. If writing for literature, kindly give the name of our publication.

Pumps, Engines, Hoists.—If you have hoisting problems, write to Mr. Clarence E. Bement, of the Novo Engine Company, 200 Porter Street, Lansing, Michigan, asking for a free copy of Novo Hoisting Handbook. This is not a catalog but a book of useful information for the man who must meet hoisting problems. They will also be glad to send you full particulars concerning their entire line of products.

Lumber.—For the users of lumber, the National Lumber Manufacturers' Association, Transportation Building, Washington, D. C., has much valuable information in booklet form, which they will be glad to send you. Bulletin No. 16 is called "Simplified Practice" and another booklet containing much general information is called "Information on Lumber and Where to Find It." Either of these booklets will be sent without obligation by addressing the company at Dept. 4651, at the address given above. If applying for a copy, kindly use the name of our magazine.

Slackline Cableway.—"Excavating for Profit" is the name of a booklet issued by Sauerman Bros., Inc., 428 S. Clinton St., Chicago, giving many instances of work done by a Sauerman machine which presented problems to the contractor to know how to handle the job at a profit instead of a loss. We would appreciate the use of our name if writing for a copy of this booklet.

Mast Hoist.—The Insley Manufacturing Company, Indianapolis, Indiana, invite your inquiries in regard to the results obtained by the use of their mast hoists. This piece of equipment handles concrete with the buckets and chutes, and also hoists miscellaneous material with a material elevator operating independent of the bucket, and with a boom handles such material as reinforcing steel which is too long for an elevator. Write for literature giving complete information on this machinery. Mention of this magazine would be appreciated.

Governors.—How to increase production and profits and lower operating costs, by the use of Pierce Governors, is described in Booklet No. 14, issued by the Pierce Governor Company, of Anderson, Indiana. This equipment on power engines results in a smooth, uniform flow of power to meet every load. Fuel, operating and repair bills are reduced and the life of engines prolonged. Mr. D. J. Nolan, of the Pierce Governor Company, will be pleased to send you a copy of this booklet, and we should be pleased if you would mention our magazine when writing.

Cranes - Shovels - Draglines. — The Koehring Company, of Milwaukee, Wisconsin, manufacturers of pavers, mixers, gasoline shovels, cranes and draglines, would be pleased to send you detailed information concerning their heavy duty construction equipment. This company emphasizes the service which goes with all sales of their equipment, and their sales offices and service warehouses are located in all the principal cities. Kindly mention the name of our publication if writing Mr. O. C. Dahlman of the Koehring Co., for literature on this equipment.

Tractors.—Caterpillar Tractor Company, San Leandro, Calif., will be pleased to send you literature on how to spread your profits by the use of their caterpillar track-type tractors and tracks so that the bull-doze blades can be run up to the very edge of dumps, spreading and filling in as fast as the earth is dumped. Write for information, mentioning this magazine.

Shovels-Draglines-Cranes-etc. — The Osgood Company of Marion, Ohio, makers of pile drivers, cranes, clamshells, shovels, draglines, back hoes, etc., will be pleased to have you write them, giving your requirements. They will furnish you with full information to meet these requirements without obligating you in any way. When writing give the name of our publication.

Electric Calculator.—For the man who has to figure, the Burroughs Electric Calculator offers lightning like help in checking stresses and strains, dimensions, areas, cubic content, estimates, payrolls, costs or other calculating. Write to the Burroughs Adding Machine Company, Detroit, Michigan, attention of Mr. H. J. Boone for further information about this electric calculator. If you will mention our magazine, it will be appreciated.

Shovels.—Gasoline, steam or electric powered shovels, cranes, draglines and backdiggers manufactured by the Thew Shovel Co., Lorain, Ohio, will be described to you in detail, with stories of what they have accomplished, if you will write for particulars to Mr. Joe Selzer, c/o The Thew Shovel Company, giving the name of this magazine.

Explosive.—For lowering blasting costs the Hercules Powder Company advise that you investigate without delay the results accomplished by the use of Hercomites. Full information concerning Hercomites No. 2 to No. 7 will be sent if you will write to Mr. N. S. Greensfelder, Hercules Powder Company, Wilmington, Delaware, mentioning this publication.

Cement.—Of interest to the cement users is the new booklet issued by The Universal Portland Cement Company, called High Early Strength Concrete. This booklet gives full details for securing strong concrete in three days with the usual materials and labor. Write to Mr. Charles S. Rye of the Chicago office of the Universal Portland Cement Company for a copy of this booklet. We would appreciate your mentioning our magazine if writing.

Electric Power.—A very attractive forty-eight page booklet, well bound and profusely illustrated, is now being distributed by the Electric Machinery Manufacturing Company of Minneapolis, Minnesota. It is devoted to the subject of power factor correction with capacitors (static condensers). The title of the book is "Reducing the Cost of Electric Power" and gives a non-technical explanation of power factor and shows when and how to apply capacitors to reduce electric power cost. It also explains the construction of capacitors. This company has offices in all the principal cities where copies of this book may be secured, or from their main office at Minneapolis.

Cranes, Clamshells, Draglines, Skimmers, etc.—Write for Bulletin 45-D if desiring full information regarding the Universal-35, the new ½-yard machine of the Universal Crane Company. This is the 2-speed center drive crawler, a powerful rope crowd center drive shovel, readily convertible to crane, clamshell, dragline, skimmer, and backdigger. There is no obligation on your part in asking for this bulletin, just write to Mr. J. L. Beltz of the Universal Crane Company, 1324 E. 28th Street, Lorain, Ohio, for a copy, mentioning the name of our magazine.

Portable Flasher.—The Eveready Portable Flasher, is manufactured by the National Carbon Co., Inc., and when operated continuously the Columbia Dry Batteries should last two months. This is because the intermittent character of the load has been calculated to get the longest possible service from the battery. The operating cost of the Eveready Flasher is low, and the only attention required is the changing of batteries every two or three months. The National Carbon Company has offices in the principal cities, or they will be pleased to receive your inquiries at their New York office, 30 East 42nd Street, and will send you complete information in regard to this serviceable warning signal. If writing kindly give the name of our magazine.

Bituminous Heating & Distributing Unit.—Catalog KHD, issued by the Good Roads Machinery Co., Inc., Kennett Square, Pa., will give you complete details concerning their new Champion Bituminous Heating and Distributing Unit, for the application of asphalt and tar products. Write for description of this piece of equipment and then look it over at the Road Show. In addition to catalog KHD this company has a new catalog on sand and gravel KSG. Both of these catalogs will be found very helpful to persons interested in these fields. Booklets are profusely illustrated and contain useful tables. If writing for copies, please mention our magazine. Mr. J. W. Kitts is advertising manager and will be pleased to see that this literature reaches you.

Rock Drills.—The new Sullivan Rotator "L-8" is fully described in their new Bulletin 581-T. Write to Mr. S. B. King of the Sullivan Machinery Company, 76 East Adams Street, Chicago, for this booklet. The "L-8" features automatic rifle-bar rotation of the bit; improved steel retainer; automatic lubrication; automatic ejection of cuttings from drill hole; cushioned return stroke; adaptability to use on mountings; simplicity and convenience; drilling speed and power. Selected steels and Sullivan standard workmanship are employed in the perfection of these drills. If writing to Mr. King for information kindly refer to our magazine.

Calcium Chloride.—The Solvay Sales Corporation, have for free distribution a book on the use of calcium chloride in concrete construction. Their product, Solvay Calcium Chloride, is recommended for making stronger and denser concrete in any weather, but particularly for construction in freezing weather to insure profitable work. Much practical information is given in Booklet 6553. It is yours for the asking. Mr. A. T. E. Newkirk of the Solvay Sales Corporation, 40 Rector Street, New York, will be pleased to send it to you. If writing to Mr. Newkirk, kindly mention our magazine.

Asphalt.—The National Asbest-O-Phalt Corporation located in the Builders Building, Chicago, places the services of their engineering department at the disposal of architects, contractors and engineers for the purpose of investigating the uses of Asbest-O-Phalt in its many forms. There is also an office in New York to serve the eastern territory and one in San Francisco for the far west, as well as offices in London and Paris, for information concerning this modern chemical development of a product comparable with the natural asphalt of the ancients. If writing or consulting the National Asbest-O-Phalt Corporation we will appreciate it if you will give the name of our magazine.

Excavating.—A limited edition of a copyrighted piece of literature called "Excavating in Pre-Drained Wet Soils" is yours if you care to write to the Domestic Engine & Pump Company, N. Queen Street and P. R. R., Shippensburg, Pa., and request that a copy be sent to you. This booklet contains valuable information for engineer and contractor. We would appreciate it if you would mention our publication when writing for a copy.

Tractors.—Literature on the Atlas 4-wheel drive and 4-wheel steer tractors will be sent to you without obligation if you will write to Mr. C. W. Zimmerman, c/o The Atlas Engineering Company, Clintonville, Wis., mentioning our magazine. Particulars as to construction and performance will be furnished. This tractor is particularly well adapted for climbing hills, crossing ditches and pulling stumps and other heavy loads.

Floor Plates.—A new bulletin is now available describing the service of the Central "Knobby" Non-Skid Floor Plates, manufactured by the Central Iron & Steel Company, Harrisburg, Pa. These plates will stand the wear and tear of the most constant traffic. This company has offices in the principal cities, where information can be secured, or by writing direct to Mr. L. F. Nagle, Central Iron & Steel Company, Harrisburg, Pa., using the name of our paper.

Cresolac.—This is a transparent waterproofing preparation for brick, concrete, stucco, stone and plaster surfaces, and can be used without stain or discoloration. For full information concerning this product write to the Ceresit Waterproofing Corporation, attention Mr. F. A. Mitchell, 512 So. Canal St., Chicago. We would appreciate mention of our magazine if writing for particulars about this product.

Dredges.—Catalog E issued by the Norbom Engineering Co., Darby, Pa., gives full particulars concerning the Norbom Hydraulic Dredges. These dredges will be built to suit your special requirements. Write for a catalog giving the name of our magazine.

Textured Tile for Building.—The Clay Products Company, Inc., of Brazil, Ind., has just issued a very beautiful as well as authoritative text book on textured tile. It is a 60-page catalog, in loose leaf style, with cover and inside plates in nine colors. In presenting this catalog for the consideration of architects, engineers and builders, Mr. E. C. Gaertner, sales manager for the Clay Products Company states: "Textured tile is really a new type of building material, and we felt that architect, engineer and builder were entitled to a thorough treatise on the subject. We believe this is the most elaborate work of its kind that has ever been published." As rapidly as this field develops, additional pages will be sent to all the owners of the catalog to keep it up-to-date, which was the purpose in adopting the loose-leaf style of binding.

Bags.—Let the Bates Valve Bag Corporation, 35 Wacker Drive, Chicago, tell you about their multi-wall-paper bags in a very attractive folder which they have recently issued. These bags are proving of inestimable value to the contractor in protecting his plaster from losses by the elements. This company also manufactures the Bates Ties and Tools for the use of contractors in speeding up reinforced concrete work, by fast, tight, non-slipping ties requiring no special skill to apply. Write to this company for their latest literature, mentioning the name of our publication when writing.

Inertol.—This is a waterproofing and anticorrosive compound for impregnating concrete surfaces and for protecting steel, making the structures waterproof under pressure and immune against aggressive chemicals. This is manufactured by the Inertol Company, Inc., 253 Broadway, New York City, and stocks are carried in Newark, N. J., Chicago and San Francisco. In color it is a glossy black and comes ready for use, and needs no skill in applying, but is used cold with brush or paint sprayer. An illustrated broadside has just been received from this company giving the many uses for this product, prices, etc. Write to the manufacturer for full information, mentioning this magazine.

SAVE YOUR TIME! USE OUR SERVICE! Prices on equipment, names of manufacturers or their catalogs will be cheerfully furnished to you by our Service Department. Write Municipal News and Water Works, 221 E. 20th St., Chicago.